**REPRODUCTIVE SURGERY**

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**Latest Data on Neutering Effects:** One of the most recent papers was published in July 2020: *Assisting Decision-Making on Age of Neutering for 35 Breeds of Dogs: Associated Joint Disorders, Cancers, and Urinary Incontinence* <https://www.frontiersin.org/articles/10.3389/fvets.2020.00388/full>

This study supports findings of the previous studies, noting that occurrence of joint disease in Golden Retrievers, Labrador Retrievers, and German shepherds is much higher if those breeds are neutered at 6 months or younger. In general, age of neutering had no effect on occurrence in joint disease in most small breed dogs or certain giant breed dogs (Great Danes and Irish Wolfhounds). In this paper, overall occurrence of mammary cancer was 6%, but the breed related occurrence varied from 0-15%.

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| Breed | Joint disease for thoseNeutered < 6 months | Joint disease for those Intact | Cancer ifNeutered < 6 months | Cancer for those Intact |
| Golden male | 18% | 3% |  |  |
| Golden female | 25% | 8% | 26% | 14% |
| Labrador male | 22% | 8% |  |  |
| Labrador female | 33% | 10% |  |  |
| German shepherd male | 33% | 2% |  |  |
| German shepherd female | 29% | 9% |  |  |

The following chart summarizes some of the data from the article so that you can quickly identify the effects of neutering on occurrence of joint disease, cancer, and urinary incontinence and, for Corgis, intervertebral disk disease. The chart also lists the percentages of mammary cancer and pyometra in those breeds. Additionally, I have included a chart at the end of these notes - “Suggested Guidelines by Breed for Age of Neutering” –from this same article; it includes recommendations for neutering age based on their study results. As a summary, neutering after 2 years of age is recommended for Boxer and German shepherd males and females; Cocker spaniel, Doberman, Sheltie, and Shih tzu females; and Irish wolfhound and standard poodle males. Breeds that should be neutered at 12 months or older include male Beagles, Border Collies, Boston terriers, Golden Retrievers, Miniature poodles, and Rottweilers, and female Border Collies, Collies, English springers, and Labrador retrievers. The authors recommended leaving male Dobermans and female Golden Retrievers intact because of the high risk of cancer in those dogs. For 14 breeds, there was no noticeable effect of neutering on cancer, joint disease, or incontinence rates. Interestingly, neutering had no effect on risk of disk disease (IVDD) in male and female dachshunds (risks of 53% and 38%, respectively), but percent affected dogs increased from 3% to 18% when male Corgis were castrated before 6 months of age.

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| **Breed** | **Joint disease risk with neuter** | **Cancer risk (neuter = male and female)**  | **Incontinence risk with OHE** | **Mammary cancer, Pyometra**  |
| Aus Cattle dog | 7x if OHE <6mo |  |  | Pyo 4%, MC 6%  |
| Austr shep |  | Sl. w/ OHE | 1% if OHE <6 mo | Pyo 5%. MC 0-8% |
| Beagle | 7x if castrated<1 year |  | 2% if OHE <6 months | Pyo 2%; MC 0%,  |
| Bern Mntn Dog | 3x-6x  | 2x with OHE <6 mo |  | Pyo 5%, MC 0% |
| Border Collie |  | 6x-11x w/neuter<1 yr |  | Pyo 4%, MC 1% |
| Boston Terrier |  | 2x with castration | 2% if OHE <6 mo | Pyo 7%, MC 2% |
| Boxer |  | 2x with neuter <2 yrs | 1% if spayed | Pyo 2%, MC 0% |
| Bulldog | Sl. with neuter<6 mo |  |  | Pyo 2%, MC 1-2% |
| Cavalier |  |  |  | Pyo 2%, MC 0-% |
| Chihuahua |  |  |  | Pyo 2%, MC 1-4% |
| Cocker | 11x w/castr <6 mo | 17x w/OHE <2yr (MCT) |  | Pyo 5%, MC 11% |
| Collie |  |  with OHE <6 months | 13% if OHE at 6-11 mo | Pyo 16%, MC 4% |
| Corgi | IVDD 6x castr< 6mo |  |  | Pyo 0%, MC 8% |
| Dachshund |  |  |  | Pyo 4%, MC 1% |
| Doberman | Sl. OHE <12 months  | Sl. with castration | 25% if OHE <6 mo; 19% if OHE <2 years | Pyo 7%, MC 2-4% |
| Engl Sprng Span |  |  | Sl if OHE <1 year | Pyo 0%, MC 6-15% |
| German shepherd | 3x w/neuter <1 year |  | 9% with OHE <1 year | Pyo 3%, MC 5% |
| Golden retriever | 2x-5x w/neuter <1 yr | 1.3x w/castr <6mo; 3x  w/OHE at any age |   | Pyo 4%, MC 1-4% |
| Great Dane |  |  |  | Pyo 6%, MC 2% |
| Irish Wolfhnd |  | 3x w/castr at 1-2 yrs |  | Pyo 5%, MC 0% |
| Jack Russell |  |  |  | Pyo 1%, MC 1-3% |
| Labrador | 2x w/castration<6 mo or OHE<12 mo |  | 2-3% if OHE <1 year | Pyo 2%, MC 1-2% |
| Maltese |  |  |  | Pyo 0%, MC 0.5% |
| Min schnauzer |  |  |  | Pyo 4%, MC 0% |
| Pomeranian |  |  |  | Pyo 7%, MC 1% |
| Toy Poodle |  |  |  | Pyo 0%, MC 1% |
| Mini Poodle | 9x w/castr 6-11 mo |  |  | Pyo 6%, MC 1% |
| Std Poodle | Sl w/castration <6mo | LSA 6x w/castr at 1 yr |  | Pyo 2%, MC 4% |
| Pug |  |  |  | Pyo 5%, MC 0% |
| Rottweiler | 2-3x w/castration <12 mo; 3x with OHE<6 mo | Previous paper: 2x in bone sarc if neuter<1yr | 1% if intact; 4%-6% if OHE <6 and 12 mo | Pyo 12%, MC 5-8% |
| Saint Bernard | 17x (100%!) OHE<6mo |  |  | Pyo 15%, MC 0% |
| Sheltie |  |  | 33% OHE<2yr, 6% <1yr | Pyo 14%, MC 0% |
| Shih tzu |  |  |  |  |
| West Highland White |  |  | 14% OHE<6mo, 6% if OHE<12 mo | Pyo 7%, MC 0% |
| Yorkie |  |  |  | Pyo 7%, MC 1% |

**Other reproductive notes:**

OVE vs. OHE: Ovariectomy (OVE) without hysterectomy is becoming more common, particularly with laparoscopic spays. Ovariectomy alone does not increase the risk of pyometra, since endometritis, pyometra, and stump pyometra require progestagens to develop. Ovariectomy may be less traumatic because incision size is smaller and tissues are handled less; the only increased risk compared to ovariohysterectomy (OHE) is future development of uterine tumors, which are rare in dogs (0.03%). Most of these tumors (90%) are benign leiomyomas; therefore, the true overall incidence of malignant uterine tumors is 0.003%.

Pedicle ties: In high volume spay practices, ovarian pedicles in cats are often “tied on themselves” (pedicle tie), similar to cat castration. Complication rates are low, with hemorrhage noted in 0.28% and usually detected in surgery. Pedicle tie surgeries are about 2 minutes faster than ones with suture ligation.

Ovary-sparing surgery: Hysterectomy alone as a method for preventing pyometra and avoiding the inconvenience of vaginal discharge during heat cycles is offered as an option to ovariohysterectomy. There are no studies on short or long-term outcome of the procedure. When ovary-sparing hysterectomy is performed as an open surgical technique, the incision must be large and caudal enough to see the ovaries and the cervix (Frontiers Vet Sci 2020; <https://doi.org/10.3389/fvets.2020.00342>). The vessels to the uterine horns (including those between the ovary and uterine horn) are ligated, and the distal cervix or proximal vagina is clamped, ligated, and transected. The entire uterus must be removed to remove the risk of stump pyometra, so the distal ligation must be at or beyond the caudal cervix, since the cranial cervix contains glandular tissue. Additionally, the tips of the uterine horns must be removed- this can be difficult in small or immature dogs. Dogs undergoing hysterectomy still have ovaries and will therefore experience the hormonal effects of estrus (e.g., vulvar swelling, behavioral changes) and will attract male dogs. There is a risk of vaginal rupture and peritonitis if hysterectomized dogs are allowed to copulate in the first 2 months after surgery.

Scrotal versus prescrotal castration: Scrotal castration can be performed in any size dog. Prescrotal castration is difficult in young dogs because the testicles slide into the inguinal rings, making them hard to find. Dogs undergoing prescrotal castrations and an intradermal closure have greater incidence of self-trauma and longer surgical times than those castrated through a scrotal incision and with a single simple interrupted subcutaneous stitch for closure (Woodruff et al, Vet Med 2015). Caudal scrotal incisions are also no more likely to cause complications than prescrotal incisions (Snell et al, New Z J 2015).

Autoligation techniques in dogs: Similar to cats, hemostasis in small breed dogs can be achieved by tying the cords on themselves. Complication rates of scrotal castrations performed via autoligation are similar to prescrotal castration with suture ligation.