Wilsonville Veterinary Clinic
Phone: (503) 682-3737
Fax: (503) 682-3540

REPRODUCTIVE REVOLUTIONS
Phone: (503) 982-5701
Fax: (503) 982-5718

Pregnancy Radiographs: Risk vs Benefit

Why are pregnancy radiographs recommended:

1) To determine an accurate fetal count prior to delivery. If we have a known number of fetuses, then if the bitch develops uterine fatigue, inertia or hypoglycemia and labor ceases prior to delivery of the last fetus, the owner is aware there is a problem prior to fetal or maternal compromise due to fetal death
2) To assess the safety of free whelping in terms of fetal skull size compared to maternal pelvic size. This is particularly important in the toy and small breeds; in bitches with small litter size because fetal size is not controlled by space in the uterus to grow; and in brachycephalics where fetal skull size is indiscriminately large compared to pelvic diameter and dystocias are common.

The pitfalls of pregnancy radiographs:

1) The quality of the machine used to take the films and the knowledge of the staff on altering the radiographic technique are critical to obtaining adequate film quality. Fetal bone is not as dense as adult bone and thus the technique must be increased in order to get good visualization of all fetuses present. Large breed bitches, especially those that are overconditioned, may be difficult to get quality images because the machine may not have the power to penetrate through the body wall fully. Giant breed bitches may need 2 films to cover the entire abdominal area and not miss any fetuses either near the stomach or in the very back part of the abdominal cavity. Digital radiography has improved the accuracy of radiographs by allowing manipulation of the image without having to repeat exposures.
2) Food in the stomach or colon, intestinal gas, and intestinal foreign bodies (such as ingested rocks), may obscure visualization of all fetuses
3) Bitches with very large litters (>10 fetuses) may be difficult to get accurate counts because the fetal skeletons may overlap so much that it is difficult to determine an exact number. In these cases, numbers can usually be determined to +/- 1 fetus by an experienced reproductive veterinarian.
4) The experience of the veterinarian reading the films is critical to an accurate count because as fetal numbers increase the difficulty in matching skulls with spines and differentiating skulls or spines from other abdominal contents (gas, feces, ingesta, foreign material) increases. More experienced reproductive veterinarians will be more accurate than those with less experience.
5) Taking films too early in pregnancy when fetal mineralization is not complete will reduce the accuracy of the count because some fetuses may not be visualized. Waiting till the last week of pregnancy (and knowing when the last week of pregnancy actually is either based on ovulation timing or gestational aging via ultrasound) will provide the most accurate counts.

Concerns about pregnancy radiographs:

1) Exposure of fetuses to radiation – this is a much more significant concern in early or mid-pregnancy than at term because cellular differentiation and organ development from early to mid-late pregnancy is still occurring at a rapid rate and exposure to radiographs during these rapid growth phases may affect cell lines more significantly. Close to term, cellular lines are developed, while cellular function is still changing, and the effects of radiation exposure is much less of a concern.
2) The amount of radiation exposure for a single (or two) diagnostic images is miniscule compared to the amounts of radiation applied in most human and animal studies on impacts of x-radiation on childhood or adult onset neoplasia. Every rodent study used 10 – 10,000+ times the amount of radiation than in a single diagnostic radiograph. Care must be taken interpreting rodent studies because rodent fetuses have a much shorter gestation length (17-21 days) and are born in a much more undeveloped state than are dogs or humans. All dog studies used doses of 100 – 10,000 times the amount of radiation in a single diagnostic radiograph.

   There are some human retrospective studies that look at the effects of diagnostic radiographs on childhood and adult onset cancers. The results from these studies are mixed with most showing no impact, and a few showing a 1% (or less) increase in solid tumors in adults over 35 years of age. The tumors of most concerns with radiation exposure are solid tumors of the spleen or lymph nodes. There was no increase in incidence of leukemia or lymphoma in childhood. While a 1% increase is significant, there are more studies showing no impact than those showing a 1% or less increase, and each of these studies is retrospective, so they are not blinded or well-controlled studies and may have differences in patient populations selected, areas of the world where performed (some in developing countries or industrial nations where there is either poor health care or heavy potential toxin exposure which may impact cancer development), so the results must be viewed with caution. Most of the human studies that showed an increased risk of cancers, radiation doses were larger than a diagnostic film dose. Those studies using single film exposures with diagnostic film doses, showed no significant difference in cancer incidence.

Conclusions:

So, as best we can determine from these studies, the amount of x-radiation in a single diagnostic image is most likely too small to have any significant impact on long term quality of life for dogs. The conclusion drawn by doctors and all these papers is that if the benefit of the diagnostic outweighs the risk, then there is benefit. So if and when pregnancy radiographs are to be taken, they should be as close to term as possible, when organ development is through its sensitive stages so the risks of injury or gene damage are far lower. Taking x-rays early- or mid-pregnancy possesses far greater risk.

References:

1) Brent, Robert. Pregnancy and Radiation Exposure – Health Physics Society – http://www.hps.org/hpspublications/articles/pregnancyandradiationexposureinfosheet.html; August 2011.

2) Linet MS, Slovis TL, Miller DL, et al. Cancer risks associated with external radiation from diagnostic imaging procedures. CA Cancer J Clin 2012; 62: 75-100.