PAPER SYNTHESIS

STAGE II

UTILIZING NON IONIC CONTRAST SUBSTANCES IN THE RADIODIAGNOSIS OF DOGS

30.10.2008
INTRODUCTION

Percek, (1927), considers that the „radiologist is just like the surgeon which investigates the internal medium of the organism, but the scalpel is replaced by a radiant energy fascicule’.

The value of the Rx image depends on its quality and the way it is interpreted and the data integrated. The technical factor is of high importance. Using bad techniques and untrained personnel will lead to obtaining images that have no value whatsoever in the diagnosis process, therefore the radiologist needs to respect the following:

➢ Picking the best way to restrain and position an animal on the table;
➢ Choosing the best incidence;
➢ Choosing the best electrical elements in the table;
➢ Correct processing of the image.

Radiology enhances the medical senses that we use, as an example, a Rx image will come as a help in diagnosis when we have already auscultated and percuted the lung.

In modern times, ionic and then non-ionic contrast substances have one of the most important roles in radiology, being essential for the radiodiagnosis. Of course, an ideal formula might not be available yet, but the non-ionic monomers seem to get as close as possible to it.

Contrast substances used until now had excellent vascular tolerability but were also hyper osmotic, with a negative effect on the vascular endothelium.

Once the new non ionic contrast substances were discovered, which had double osmolarity compared to blood, with extraordinary physical and chemical traits, these only increase tolerability and lowers the influence on the target organs: nervous system, kidneys, heart, proteins and enzymes in the blood. These fourth generation non-ionic macromeres are highly efficient in diagnosing certain pathological processes in an early stage.

When it comes to the used incidences, positions that are used, they vary from patient to patient depending on the goal the radiologist has in mind.
STAGE II OBJECTIVES OF THE PROJECT 2008

The general goal of this research lies in certain establishment of the fact that non-ionic contrast substances can be used in the radiodiagnosis of the dog with the goal of obtaining high quality Rx images, which are necessary in establishing appositive diagnosis without endangering the animal’s life.

Objectives of the second stage of the project
O₁ – Establishment of the incidence and exposure modus of the animal so one can obtain high quality images;
O₂ - Establishing the necessary parameters for the obtaining of Rx images;
O₃ - Establishing kilovoltage and miliamperage depending on the pursued goal.

Research activities for the second part of the project:
A₁- Establishment of the incidence and exposure modus of the animal so one can obtain high quality images on the body part in question;
A₂ - Establishing the necessary parameters;
A₃ - Establishing kilovoltage and miliamperage;

A₁ - Establishment of the position of the animal so one can obtain high quality images on the body part in question
Radiological examination with contrast substances has involved the urinary apparatus, the cardiovascular system, the spinal canal, genital apparatus examination in bitches.
To identify the correct position of the animal on the Rx table, one has to think about the fact that the intensity of the X rays diminishes from the center of the focus towards the anode and increases towards the cathode.
The position of the animal was chosen according to the examined anatomical segment:
1. Examination of the urinary apparatus (urography, cystography, ureterography)
   • IV ‘bolus’ administration of the contrast substance;
   • Slow infusion of the contrast substance;
   • cystography;
   • ureterography;
Radiological investigations of the urinary apparatus were influenced by certain external and internal factors that have created certain difficulties in the proper development of investigations, caution being needed to obtain images that are valuable both through quality and through interpretation.
Therefore, negatively influencing factors on the image quality are: the presence of tissue that has weak absorption power, abdominal organ topography which creates overlapping, full digestive system with dense material and gas, anxious animals etc.
These factors were attenuated by the identification of correct positions of placing the animal on the table. Positioning the animal in a dorsal ventral recumbence allows a dorsal ventral exposure, which favors the opening of the abdominal cavity and avoiding organ overlapping over the urinary apparatus. For the evidentiation of the urinary bladder, the dog was placed in lateral recumbence and the exposure was lateral-lateral (fig. 1, fig. 2, fig. 3, fig. 4)
In order to allow the evidentiation of the urinary apparatus, the animal was on a diet for 12 hours before contrast substance administration and radiological examination.
1. Ventral dorsal exposure after 1 minute Ultravist admin – dorsal-ventral recumbence  
2. Ventral dorsal exposure after 10 minutes Optiray admin – dorsal-ventral recumbence  
3. Ventral dorsal exposure after 15 minutes Optiray admin – dorsal-ventral recumbence  
4. Lateral lateral exposure after 10 minutes from Optiray admin – lateral recumbence (ureterography)  
A – Evidentiation of the kidney  
B – Evidentiation of the urethers  
C – Evidentiation of the urinary bladder

2. Cardiovascular apparatus examination (angiography)

We obtained good results with both our contrast substances (Ultravist, Optiray), when the radiological exposures were performed right at administration.

The thoracic abdominal part of the descending aorta is very well evidentiated in the first seconds after bolus adminsitration of the substance. The best visibility is obtained in a lateral lateral exposure.

For the visualization of the external iliac artery as a terminal branch of the descending aorta, the dog needed to be positioned laterally and the exposure to be lateral lateral, respectively dorsal ventral recumbence with a ventral dorsal exposure (fig. 5).

A good evidentiation of the heart and the origin of the aorta is obtained by positioning the animal in lateral recumbence, with the left side on the box, and exposing lateral lateral, respectively in dorsal ventral recumbence and ventral dorsal exposure.
3. Spine canal evidentiation (myelography)
Myelographies evidentiate the cervical and lumbar part of the spine canal. For both areas the position of the dog was of lateral recumbence with a lateral lateral exposure which is the only relevant exposure for the contrast substance examination of the spine canal (Fig. 6, Fig. 7).

4. Intraarticular space evidentiation (artrography)
The evidentiation of the intra articular space in radiological accessible joints: shoulder joint (scapular humeral), elbow joint (humerus-radius-ulna), hip joint (coxal femoral), knee joint (femoral-tibial-patellar), hock joint (tibial tarsal metatarsal). Its purpose has the goal of the evidentiation of possible shape and volume changes of the joint sack.
The exposures were the following:
- Shoulder joint – lateral-lateral (medial-lateral) exposure;
- Elbow joint – lateral-lateral (medial-lateral) exposure, anterior-posterior, ventro-dorsal exposure; (fig. 8)
- Hip joint – expunere lateral-lateral (medial-lateral) exposure, ventro-dorsal exposure;
- Knee joint – lateral-lateral (medial-lateral) exposure, anterior-posterior exposure; (fig. 9)
- Hock joint – lateral-lateral (medial-lateral) exposure, anterior-posterior exposure;
5. Examination of the genital apparatus in bitches (Histerosalpingography)
The goal is to identify precocious alterations in this level or eventual obstruction in the cervix or salpinx.

The position was dorsal ventral, whereas the exposure was ventral dorsal (fig. 10, fig. 11).
A2 – Establishment of the necessary parameters

The quantity of substance needed, exposure time and exposure interval were different depending on the technique we used and the animal’s size, therefore:

<table>
<thead>
<tr>
<th>Used radiological technique</th>
<th>Exposure duration</th>
<th>Exposure interval</th>
<th>Quantity (CS)</th>
<th>Ultravist</th>
<th>Optiray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urography</td>
<td>Fast adm.</td>
<td>1 – 10 minutes</td>
<td>2,5 – 3,5 ml/kgc</td>
<td>2,5 – 3 ml/kgc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slow adm. (diluted 1:1)</td>
<td>1 – 30 minutes</td>
<td>3,2 ml/kgc</td>
<td>3 ml/kgc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cystography</td>
<td></td>
<td>30-50 ml (4-6 ml/kgc)</td>
<td>20-40 ml (3-5 ml/kgc)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ureterography</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angiography</td>
<td>0,1-0,2 s</td>
<td>1 – 6 seconds</td>
<td>1,5 – 2,5 ml/kgc</td>
<td>1,3 – 2 ml/kgc</td>
<td></td>
</tr>
<tr>
<td>Myelography</td>
<td>Cervical</td>
<td>1 – 30 minutes</td>
<td>0,4 – 0,5 ml/kgc</td>
<td>0,3 – 0,4 ml/kgc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lumbar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artrography</td>
<td>Shoulder joint</td>
<td>0,2-0,3 s</td>
<td>2,5 – 3 ml</td>
<td>2,0 – 2,4 ml</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elbow joint</td>
<td></td>
<td>2 – 2,5 ml</td>
<td>1,8 – 2,0 ml</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hip joint</td>
<td></td>
<td>0,5 – 1 ml</td>
<td>0,2 – 0,6 ml</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knee joint</td>
<td></td>
<td>3 – 3,5 ml</td>
<td>2,4 – 2,8 ml</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hock joint</td>
<td></td>
<td>1,5 – 2 ml</td>
<td>1 – 1,5 ml</td>
<td></td>
</tr>
<tr>
<td>Histerosalpingography</td>
<td>0,2 -0,3 s</td>
<td>1 – 10 minute</td>
<td>30 – 60 ml</td>
<td>30 – 45 ml</td>
<td></td>
</tr>
</tbody>
</table>

A3 – Establishing kilovoltage and miliamperage

Kilovoltage and miliamperage were established according to the used radiological technique, de animal’s size and the area to be examined:

**Kilovoltage** influences the power of the X ray to penetrate the tissue and it is indirectly proportionate to the image’s contrast.

**Miliamperage** influences X ray intensity, and it is directly proportionate to the image quality.

<table>
<thead>
<tr>
<th>Used radiological technique</th>
<th>Kilovoltage (kV)</th>
<th>Miliamperage (mAs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urography</td>
<td>48 – 66Kv</td>
<td>28 – 45 mAs</td>
</tr>
<tr>
<td></td>
<td>Fast adm.</td>
<td>Slow adm.</td>
</tr>
<tr>
<td></td>
<td>Cystography</td>
<td>Ureterography</td>
</tr>
<tr>
<td>Angiography</td>
<td>Angiography</td>
<td>25 – 45 mAs</td>
</tr>
<tr>
<td>Myelography</td>
<td>Myelography</td>
<td>50 – 60 Kv</td>
</tr>
<tr>
<td>Artrography</td>
<td>Artrography</td>
<td>40 – 55 KV</td>
</tr>
<tr>
<td>Histerosalpingography</td>
<td>Histerosalpingography</td>
<td>20 – 40 mAs</td>
</tr>
</tbody>
</table>

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30.10.2008       Prof. Dr. Papuc Ionel