Handbook of radiographic positions and projections in the dog

A practical book that will answer your questions about how to perform the right X-Ray and will help you to avoid unnecessary repetition of exposures. It explains the radiographic positions for the examination of every organ or structure as well as the appropriate radiologic parameters.

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Aimed at veterinary surgeons, students, teachers and other professionals in the veterinary sector.

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**TECHNICAL DETAILS**
Introduction

1. Examination of the head
2. Examination of the thorax
3. Examination of the abdomen
4. Examination of the spinal column
5. Examination of the forelimb
6. Examination of the hind limb
The position of the patient is determined by the projection that is required. The terminology of radiographic projection refers to the path taken by the X-ray beam through the structure that is being radiographed. The first part of each term describes the surface of the structure where the primary beam enters the tissue, and the second part the surface where it exits. For instance, a ventrodorsal projection of the abdomen indicates that the X-ray beam enters the abdomen ventrally and exits dorsally (Fig. 2).

The term “position” (right or left) used in a lateral projection refers to the side the patient is lying on and not to the projection. For instance, a lateral projection in a right-hand position means that the patient is lying on the table on its right-hand side (Fig. 3).

The amount of scattered radiation that reaches the film increases with a widening beam, so the beam should be as narrow as possible. Also, scattered radiation increases with the thickness of the structure being radiographed. Generally, when the thickness is over 10-15 cm, scattered radiation is considered to impair the quality of the image, and the use of an anti-scatter grid is recommended.

A grid is a device made of sections of radiopaque (usually lead) and radiolucent (usually aluminum or plastic) materials. The X-rays that emerge from the patient collide with the radiopaque material in the grid and are absorbed, so that they do not reach the film, while those X-rays that impact with the radiolucent material are transmitted. Normally, a well-designed grid will reduce scatter by 80-90%. However, it should be remembered that the grid, apart from absorbing the scattered radiation, will also absorb some primary radiation. Therefore, exposure factors should be increased in compensation (the mAs up to 30%), which means that the patient will receive a higher radiation dose.
Tympanic bullae and odontoid process

For a complete radiological examination of the tympanic bullae, two special projections are required: an oblique lateral projection and a rostrocaudal open-mouth projection.

For the oblique lateral projection (Figs. 9 and 10):
- Place the patient in lateral recumbency, with the affected side on the table.
- Place the head on the cassette in such a way that the median plane of the head is in a parallel position to the tabletop, then rotate the dorsal surface of the head some 30º towards the table, so that the affected side moves into a ventral position. A foam wedge can be placed under the lower jaw to maintain the head in position.
- Ensure that the ears do not interfere with the image by moving them out of the way dorsally.
- Centre the primary beam on the area to be explored under the eye.

For the rostrocaudal open-mouth projection (Figs. 11 and 12):
- Place the patient in dorsal recumbency with its head on the table. Sandbags may be used on both sides of the body to avoid rotation.
- Pull the forelimbs back alongside the body and fix them in this position with whatever means available (sandbags, bandage, rope...).
- Place the muzzle in a vertical position facing the X-ray tube, in such a way that the hard palate is parallel to the primary beam (in dolichocephalic breeds) and fix it in position with a bandage. In mesocephalic dogs, the angle between the hard palate and the perpendicular beam should be about 10º, while in brachycephalic breeds the angle should be 20º.
- With the aid of another bandage, pull the lower jaw backwards to open the mouth, or pull the tongue backwards, as is shown in Fig. 11.
- Ensure that the ears do not interfere with the image by moving them sideways.
- Centre the primary beam on the base of the tongue or the soft palate.

The rostrocaudal open-mouth projection is the projection of choice to for visualizing the tympanic bullae, because it avoids overlap with other structures, and because it allows for a comparison between the two bullae on the same radiograph.

At the same time, this projection provides excellent visualization of the odontoid process of the axis.

For making a diagnosis, it is advisable to take a radiograph of the contralateral bulla and compare the two.
General considerations

Radiographs of the thorax should be made at full inspiration.

Keep the head in a normal position.
Pull the forelimbs forward to avoid soft tissue superimposition on the cranial thorax, which will lead to artefactual soft tissue radiopacity (Figs. 6 and 7).
Centre the primary beam at the level of the cardiac silhouette (fifth intercostal space). The place where the cardiac apex can be felt beating against the thoracic wall may be of help when centring the beam.
The complete thorax should be included (from the thoracic inlet to the most caudal part of the caudodorsal lung field).
Wait for full inspiration to expose the film. A good radiograph of the thorax must coincide with an inspiration of the patient to obtain maximum pulmonary contrast.

After the Lat projection, a perpendicular view should be obtained: either a dorsoventral (DV) or a ventrodorsal (VD) projection.

Dorsoventral projection (DV)
For the dorsoventral (DV) projection (Figs. 8 and 9):
Place the patient in sternal recumbency.
Keep the head on the table in a natural position.
Pull the forelimbs forward and the hind limbs backwards.
Centre the primary beam on the cardiac silhouette (5th intercostal space).
Include the complete thorax.
Expose the film at the moment of full inspiration.

Ventrodorsal (VD) projection
For the ventrodorsal (VD) projection (Figs. 10 and 11):
Place the patient in dorsal recumbency.
Keep the head in a natural position.
Pull the forelimbs forward and the hind limbs backwards.
Centre the primary beam on the xiphisternum.
Include the complete thorax.
Expose the film at the moment of full inspiration.
Elbow

For radiological examination of the elbow, with its complex anatomical structure, different projections can be used that make it possible to assess the complete joint.

As discussed in the general considerations, from the elbow down it is rarely necessary to use an anti-scatter grid, because, as long as the beam is sufficiently collimated, the amount of scattered radiation will be minimal due to the reduced thickness of the area.

First, the mediolateral (ML) projection is described, which is always the first option in any radiological study of the elbow. For this projection:

- Place the patient in lateral recumbency with the affected side on the table (Fig. 13).
- Pull the affected limb cranially.
- Pull the healthy limb caudally and secure it there.
- Centre the primary beam on the medial epicondyle of the humerus.
- Move the head and neck slightly dorsally out of the way.

Another projection used for the elbow joint is the neutral ML, in which everything is identical to the previous position, except that in this case the elbow is flexed by approximately 90°. This may be useful for visualization of fractures and to assess the state of the subchondral bone caudal to the semilunar notch of the ulna.

Occasionally, in particular when elbow dysplasia is suspected, an ML projection in forced flexion is required (Fig. 15). This is already required by certain breed societies. The position of the animal is the same as for the two previous projections, but this time the radiograph is taken with the elbow in maximal flexion, in order to avoid superimposition of the anconeal process of the ulna on the epicondyles of the humerus. In this way, its dorsal surface can be checked for osteophytes and the separation of the anconeal process from the ulna in case of ununited anconeal process can be assessed.

To avoid rotation of the elbow in this position, a foam wedge is placed under the foot and carpus.

The projection of the elbow in forced flexion allows correct visualization of the whole anconeal process of the ulna, as there is no superimposition on the humeral epicondyles.

With this projection (Fig. 14), an excellent assessment of joint congruity is possible, when dysplasia of the elbow is suspected.