Abstract

Ultrasonography is an imaging technique that is very popular in veterinary medicine. The high availability of equipment, relatively short examination time and no exposure of the patient and staff to ionizing radiation make this method commonly used to examine the abdomen or thorax, as well as the musculoskeletal system. There are reports in the available literature regarding the possibility of using ultrasound to image spinal structures in dogs to perform various procedures, mainly in the lumbar and sacral spine. However, no detailed sonoanatomy of the lumbar spine has been described so far, nor have any pathological lesions in its area been identified using ultrasound, with the exception of examinations performed intraoperatively.

The lumbar spine consists of seven vertebrae, connected by intervertebral discs and short and long ligaments; the paraspinal muscles are directly adjacent to it. The vertebrae are equipped with spinous, transverse and articular processes, which provide support for the above-mentioned muscles and a place of attachment for the elements of the ligamentous apparatus. Intervertebral discs are composed of the nucleus pulposus and the annulus fibrosus.

Diseases occurring in the lumbar spine in dogs affect both the vertebrae and intervertebral discs. Intervertebral disc disease affects both chondrodystrophic breeds and dogs with typical body build. The protrusion of the intervertebral disc dorsally causes pressure on the spinal cord, which results in neurological disorders, manifested mainly as paresis or paralysis of the pelvic limbs. Spondylosis is a disease involving the formation of bony outgrowths on the edges of the vertebral bodies, which can fuse together, forming bone bridges, significantly limiting the mobility of the spine and causing pain.

The aim of this doctoral dissertation was to develop a protocol for examining the lumbar spine of dogs using ultrasound, which was used to directly describe its sonoanatomy, taking into account individual anatomical structures, such as vertebral elements, intervertebral discs, ligaments and paraspinal muscles. Additionally, a discussion of images obtained using ultrasound for selected lesions of the lumbar spine is planned, as well as a comparison and statistical analysis of the dimensions of individual anatomical structures of the lumbar spine in images obtained using ultrasound and low-field magnetic resonance imaging. The above stages of research were intended to demonstrate the usefulness of ultrasound as a tool for the initial assessment and diagnosis of lesions in the lumbar spine of dogs.

In the first stage of the study, which aimed to develop a research protocol and describe the ultrasound anatomy of the lumbar spine, 23 dog cadavers were used. Each time, the ultrasound examination was preceded by an X-ray examination, which aimed to exclude pathological changes in the lumbar spine. The dogs were each placed on their left or right side and examined using a

linear transducer with a frequency of 3-13 MHz. The established examination protocol was aimed at imaging as many anatomical structures as possible and included four acoustic windows, applied dorsally, laterally and ventrally, in the longitudinal and transverse planes. The protocol allowed for visualization of vertebral bodies and transverse, spinous and articular processes, intervertebral discs, long and intertransverse ligaments, and paravertebral muscles, such as the multifidus, semispinalis, and iliocostal and longissimus dorsi muscles.

The second stage of the study included 20 dogs, which are patients with neurological disorders neurolocalized in the lumbar and sacral spine. The dogs were sent for magnetic resonance imaging, followed by an ultrasound examination of the lumbar spine according to the protocol established in the first stage of the study. Based on the examinations performed, it was possible to identify pathological changes such as mineralization and dehydration of the intervertebral disc and spondylosis.

The statistical analysis was based on the comparison of measurements of the length of the vertebral bodies, the height and thickness of the intervertebral discs, the thickness of the paravertebral muscles, the height of the spinous process and the length of the transverse process. Measurements were performed on images obtained in magnetic resonance imaging and ultrasound examination. Based on the results of the statistical analysis, it was proven that ultrasound examination is a technique that can be used as a screening test allowing the identification of certain pathological lesions before magnetic resonance imaging.