ABSTRACT

P. Pech 1987. Correlative investigations of craniospinal anatomy and pathology with computed tomography, magnetic resonance imaging and cryomicrotomy.

Resolution improvements in segmental imaging have created a demand for correlative anatomic investigations. In the present work a precise method for correlation of computed tomography (CT) scans with cryosectional images was developed and applied.

Frozen specimens were embedded and CT scanned. Surface photographs of the specimens exactly corresponding to the CT images were obtained. Because frozen specimens give very low magnetic resonance (MR) signals, clinical MR images were correlated with corresponding cryosectional images.

The appearance of the pituitary fossa in sagittal partial saturation MR images was characterized in 41 normal subjects. Commonly, the contents of the pituitary fossa had inhomogeneous signal intensity. Correlation of sagittal MR scans from normal subjects with anatomic images showed that a postero-inferiorly located high intensity MR signal was caused by an intrasellar fat pad. The height of the pituitary gland was usually less than 8 mm, its upper surface was flat or concave.

The appearance of the intracavernous cranial nerves III, V:1, V:2 and VI in the coronal plane was studied in seven normal humans with magnetic resonance imaging (MRI) and correlated with anatomic images from cadavers. MR signs of parasellar masses included obliteration of the intracavernous venous spaces, displacement of the intracavernous portion of the internal carotid artery and lateral bulging of the cavernous sinus wall.

In 19 specimens the cryosectional anatomy of the cervical neuroforamina was studied in multiple planes in direct correlation with specimen CT scans. Surface coil MR images from four patients were compared with anatomic images. The cervical nerve roots were located in the lower half of the cervical foramina and were resolved with both modalities.

In an experimental trauma study, cervical spinal fractures were produced in six cadavers, CT scanned and studied by cryosectioning. Out of six isolated, non-displaced superior articular process fractures, only one was detected on axial CT scans; in each case, diastasis of the facet joint was present on the fracture side as an indirect sign of fracture. In nine isolated spinal process fractures only two with displaced fracture fragments were detected on axial CT scans.

In a multiplanar CT-anatomic investigation, one cervical spine specimen with fractures and another with a lumbar metastatic lesion were studied. CT scans in direct axial, sagittal and coronal planes were compared with reformatted CT scans. The reformatted images showed only one of four fractures. The lumbar metastatic lesion was evident in all images.

CT and anatomic landmarks of the position of the sciatic nerve complex in the pelvis were examined in nine specimens. Such landmarks were the upper sacrum, the piriformis muscle, and the spina ischiadica.

Freezing artifacts were studied in fluid phantoms, animals and humans. Pure soy oil shrunk when frozen to -20°C, whereas emulsions with oil contents of 30% or less expanded to various degrees. The volume changes were inversely related to the change in density. In human studies, the density changes of -81.0 to +55.6 Hounsfield Units (HU) after freezing would seem to reflect volume changes of +8.6% to -5.9%.

Key words: Computed tomography, cranial; - spinal; magnetic resonance imaging, cranial; - spinal; cryomicrotomy; freezing artifacts; pituitary region; cavernous sinus; cervical spine; lumbar spine; sciatic nerve.