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Possibilities Of Computed Tomography In The Diagnosis Of Central Lumbar Spinal Canal Stenosis

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Resume: The possibility of visualizing spinal pathology allows us to consider CT as the main and most accessible diagnostic method for vertebral and discogenic lesions, which can be used to accurately identify pathological changes that cause central lumbar spinal canal stenosis. CT with SCT and MSCT was perceived by many scientists as the biggest step forward in radiation diagnostics since the discovery of X-rays.

Keywords:

To date, a large number of fundamental works have accumulated, the analysis of which shows that lumbar spinal central stenosis is a fairly common disease among the general pathology of the spine.

Central stenosis is a consequence of various pathogeneticprocesses of the bone and soft tissue components of the lumbar spinal canal, and is mainly diagnosed by radiation methods. One of them is the CT method, which was discovered in 1972. The creation of spiral (SCT) and multispiral (MSCT) computed tomographs has made the CT method extremely reliable and universal for early diagnosis and screening of central spinal canal stenosis. CT with SCT and MSCT using three-dimensional reconstruction, having a high scanning speed, the ability to cover a significant length of the spine, visualizes the initial changes in the intervertebral disc, differentiates the structures of the spinal canal, the amount of disk prolapse into the canal, the size and migration of sequesters, their " age" ,i.e. gives a more comprehensive picture of degenerative-dystrophic diseases lumbar spine, including central stenosis of the spinal canal as a result of lesions of the bone and soft tissue structures of the spine.

The possibility of visualizing spinal pathology allows us to consider CT as the main and most accessible diagnostic method for vertebral and discogenic lesions, which can be used to accurately identify pathological changes that cause central lumbar spinal canal stenosis. CT with SCT and MSCT was perceived by many scientists as the biggest step forward in radiation diagnostics since the discovery of X-rays.

Objective: To study the possibilities of computed tomography in establishing the diagnosis of lumbar spinal stenosis.

Materials and methods

To determine the possibility of a computed - tomography method in the diagnosis of lumbar spinal stenosis, the structure of the lumbar spinal canal was studied in 35 patients without pathology of the lumbar spine segment. Patients of the control group and patients were examinedin the radiation diagnostics department of the multidisciplinary clinic of the Andijan State Medical Institute, the Republican Scientific Center for Emergency Medical Care, and theStar Med Center" in Tashkent.

We measured the following parameters of the lumbar spinal canal in the control group and patients with CT: theтmid-arterial and frontal dimensions of the bone border of the spinal canal, and the vertical size of the intervertebral disc in the direct and lateral projections.

CT with SCT and MSCT of the lumbar spine allows you to get a clear idea of the size and configuration of the spinal canal, to identify central and lateral stenosis. In CT scans, only thin sections of tissue are exposed to X-rays. CT has a high contrast resolution, which makes it possible to differentiate tissues with a density difference of 0.5% (radiography with a density difference of 15-20%). The CT tube emits a thin, collimated, fan-shaped beam of X-rays perpendicular to the body's long axis. By adjusting the collimation, the slice thickness was changed, for example, from 1 to 10 mm. The X-ray beam passed through the patient is detected not by a film, but by a system of special detectors. CT detectors are about 100 times more sensitive than X-ray films in detecting differences in primary beam attenuation. The primary beam attenuation is usually assigned a numerical value and is called the Hounsfield unit (HV). The CT is calibrated so that the water attenuation value is k0, and the air attenuation value is k-1000. For bone structures, the attenuation value

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ranges from +800 and above. The density value for parenchymal tissues is 60-100 HV. CT with SCT and MSCT allows you to simultaneously make from 4 to 256 computer sections and with the spiral movement of the X-ray tube, you can get an image of the entire body in a few seconds.

The obtained results were processed statistically according to Student-Fischer using criteria for the reliability of differences in the comparedy-index.

Results and discussion

As described above, CT with SCT and MSCT was used to study the lumbar vertebral canal in 35 patients without lumbar spine pathology, in whom the normalтmid-arterial and frontal dimensions of the bone border of the lumbar vertebral canal, the vertical size of the intervertebral disc in direct and lateral projections were measured. The dimensions of the listed parameters are indicated in Table 1 (numerator). Theтmid-sagittal and frontal dimensions of the spinal canal expand in the cranio-caudal direction: They were at the level Lof L1=18.00±0.84 mm and 24.70±0.96 mm, at the level Lof L5=21.31±0.86mm and 30.60±0.82 mm, respectively. At the same time, the frontal size of each lumbar spinal canal (from LL1 to LL5) was significantly wider ($P<0.05$) than the 1st average sagittal size. Vertical size of the intervertebral disc in direct and lateral projections. Cranio-caudal direction also significantly expanded($P< 0.001$): the intervertebral disc was at the level Lof L1-LL2= $6.43 \pm 0.38\ mm\ and\ 6.63 \pm 0.41\ mm, at\ the\ level$ Lof L5 - SS1 = 9.94 ± 0.56mm and 11.14 ± 0.67mm, respectively.

The average sagittal size of the bone borderof the L5 lumbar spinal canal in comparison withLL1 and LL2 expands with a high degree of difference (from $P< 0.05$to $P< 0.01$). Otherwise, the average sagittal size of the spinal canal (LL1< LL2; LL1< LL3; LL1< LL4; LL2< LL3; LL2< LL4; LL3< LL4; LL4< LL5) is expanded with a low degree of difference (from $P<0.8$ up to $P<0.2$). The frontal size of the bone border of the spinal canal is expanded with a high degree of difference ($P< 0.0505$) in comparison with the previous vertebral canals, except for the adjacent vertebrae, which are expanded with an insignificant difference (from $P< 0.8$to $P< 0.2$).

Table 1
Normal (numerator) and affected (denominator) CT values of lumbar segment parameters (M±m, in mm).

№	Parameters	the Level of vertebra				
		L1	L2	L3	L4	L5
1	Srednicka-Talth the size of the bony border of the spinal canal	18,00±0,84 18.15±0.58	18,69±0.811 8,25±0,65	19,80±0.87 16,60±0,45	20,29±0.86 15.43±0,43	21.31±0.86 14,55±0,37
2	Frontal bone the size of the border of the vertebral canal	24.70±0.96 24,60±0,67	26,00±0.96 24,90±0,56	27,49±0.91 25.55±0,50	29,00±0.86 26.15±0,46	30,60±0.82 27,20±0,48
3	Vertical size mejpozvonkovi drive in a straight line projection	6.43±0.38 6,05±0,31	8,57±0.42 7.48±0,28	9.00±0.49 7,13±0,30	9.89±0.52 6.03±0,29	9.94±0.56 5.63±0,26
4	Vertical size mejpozvonkovi disc in a lateral projection	6.63±0.41 6,18±0,24	7.71±0.45 6.80±0,27	8.94±0.56 7.05±0,22	10.09±0.60 6,38±0,24	11,14±0.67 6,70±0,27

Using a computed tomography method for the diagnosis of central lumbar spinal canal stenosis caused by degenerative-dystrophic diseases (protrusion and disc herniation) of the spine in 40 patients, as well as in healthy people, the following parameters were measured: the average sagittal and frontal dimensions of the lumbar-spinal canal, the vertical size of the intervertebral disc in direct and lateral projections (Table 1 denominator).

Comparing the pathological values of the parameters of the lumbar spinal canal with the normal dimensions of these parameters, the following results were obtained (Table 2): the average sagittal and frontal dimensions of the spinal canal in the affected areas (L3, L4, L5) of the lumbar vertebral segment were significantly shortened (from P< 0.05to P< 0.01), while the average sagittal size of the vertebral the channel is more shortened than its front size. Vertical size of the intervertebral disc in direct and lateral projections in the affected areas (L3-L4; L4-L5; L5-S1) of the vertebral segment.

Table 2

The degrees of difference (P) between normal (numerator) and pathological (denominator) CT values (in mm) of lumbar spinal canal parameters are presented

№	Vertebral level	Parameters			
		Mid-sagittal size of the spinal canal	Frontal size of the spinal canal	Vertical size of the interverteb-ral disc in the direct projection	Vertical size of the interver-tebral disc inthe lateral projecti-onthe lateral projection
1.	L1	18.00±0.84 18.15±0.58 t=0.15 P>0,8	18,69±0.81 18,25±0,65	19,80±0.87 16,60±0,45	20,29±0.86 15,43±0.43
2.	L2	24,70±0.96 24,60±0,67	26,00±0.96 24,90±0,56	27,49±0.91 25,55±0,50	29,00±0.86 26,15±0,46
3.	L3	6,43±0.38 6,05±0,31	8,57±0.42 7,48±0,28	9,00±0.49 7,13±0,30	9,89±0.52 6,03±0,29
4.	L4	6.63±0.41 6,18±0,24	7,71±0.45 6,80±0,27	8,94±0.56 7,05±0,22	10,09±0.60 6,38±0,24
5.	L5	18,00±0,84 18,15±0.58	18,69±0.81 18,25±0,65	19,80±0.87 16,60±0,45	20,29±0.86 15,43±0,43

They are also significantly shortened (from P< 0.01to P< 0.001) . Their shortening relative to the normal size of the vertebral segment was as a percentage in the following values: LL3-LL4=-20.9% and -24.8%; LL4-LL5=-39.1% and -38.9%; LL5-SS1=-43.5% and -44.7%, respectively.

To detect the severity of central spinal canal stenosis by CT, we focused on the detection of protrusions and disc herniation, their prevalence and location. Herniated discs are divided into localprolapse (up to 50% of the circumference of the spinal canal) and diffuse prolapse, when the bulge of the disc is uniform in more than 50% of the circumference of the spinal canal.

CT analysis of the symptoms of degenerative lesion of the lumbar spine showed that disc herniation in 61.9% of patients was single and 38.1% of cases were multiple, and 12.5% of patients had disc herniation in three or more vertebral segments. According to the localization of disc herniation, the following distribution was made: diffuse prolapse of disc herniation into the spinal canal was observed in 15.4% of patients, local prolapse-in 84.6% of patients. Local disc herniation, in turn, was divided into unilateral in 85.8% of cases, and bilateral in 14.2% of cases. Unilateral disc herniation revealed a left-sided paramedial variant in 39.4% of patients, a right-sided paramedialvariant in 24.5% of patients, a left-sided posterolateral variant in 13.9% of

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patients, and a right-sided posterolateral variant in 8.0% of patients. The most frequent disc herniation occurred at the level Lof L4-LL5=44.8% and at the level Lof L5-SS1=35.4%, in the remaining parts of the lumbar spine, disc herniation had dimensions from 4 to 9 mm, and the size of the disc herniation increased in the cranio-caudal direction.

Thus, the possibility of visualizing degenerative-dystrophic changes in the lumbar spine suggests that CT is one of the main diagnostic methods for vertebrogenic and discogenic lesions, which can be used to accurately identify bone-cartilage and intra-channel soft tissue pathological changes that cause central lumbar spinal canal stenosis. CT has an advantage over survey radiography in studying the features of the structure of the spinal canal, the position and extent of the disc that has fallen out, the causes of spinal cord compression, and the severity of degenerative processes in the intervertebral disc. However, the degree of visualization of computed tomography of intracanal soft tissue structures, including protrusions and herniated discs that cause lumbar spinal central stenosis, is significantly inferior to the magnetic resonance imaging method.

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