ejpmr, 2022, 9(9), 368-371

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

POSSIBILITIES OF COMPUTER TOMOGRAPHY IN DIAGNOSTICS OF CENTRAL SENOSIS OF THE LUMBAR SPINE

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Article Received on 21/07/2022 **Article Revised on 10/08/2022** **Article Accepted on 31/08/2022**

SUMMARY

To determine the central stenosis of the lumbar spinal canal, the CT method was used to study the lumbar spinal segment in 35 patients without pathology of the lumbar spine (control group) and 40 patients with degenerative-dystrophic diseases of the lumbar spine. They measured the mid-sagittal and frontal dimensions of the lumbar spinal canal, the vertical size of the intervertebral disc in the frontal and lateral projections and found that the dimensions of the lumbar spinal canal in the control group in the caudal direction expand, the intervertebral disc thickens. Comparing the pathological values of the parameters of the lumbar spine with the norm, the following results were obtained: the mid-sagittal and frontal dimensions of the spinal canal, the vertical size of the intervertebral disc in the affected vertebrae (L3; L4; L5; L3-L4; L4-L5; L5-S1) reliably narrowed or shortened. Pathology is more pronounced in the caudal regions. Thus, with the help of CT, it is possible with high accuracy to identify intracanal pathological changes that are the cause of central stenosis of the lumbar spinal canal.

KEYWORDS: lumbar spine, central stenosis, computed tomography of the spine.

The ability to visualize the pathology of the spine allows us to consider computed tomography (CT/MSCT) 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 stenosis of the lumbar spinal canal

The aim of the study is to study the possibilities of computed tomography in establishing the diagnosis of lumbar spinal stenosis.

MATERIALS AND METHODS

To establish the possibility of the MSCT method in the diagnosis of lumbar spinal stenosis, studies of the structure of the lumbar spinal canal were carried out in 35 patients without pathology of the lumbar spine and 40 patients with degenerative diseases of the lumbar spine. Patients of the control group and patients with pathology were examined in the radiology department of the multidisciplinary clinic of the Andijan State Medical Institute, the Republican Research Center of Emergency Medicine and the Star Med Center Medical Center in Tashkent.

The control group and patients with spinal pathology underwent MSCT studies with measurements of the following parameters of the spinal canal: mid-sagittal and frontal dimensions of the bone border of the spinal canal, vertical size of the intervertebral disc in frontal and lateral projections.

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 stenoses. In MSCT, thin sections of tissue are exposed to x-rays. MSCT has a high contrast resolution, which makes it possible to differentiate tissues with a density difference within 0.5% (radiography with a density difference of 15-20%). The MSCT tube emits a thin, collimated, fan-shaped X-ray beam perpendicular to the long axis of the body. 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 fixed not by a film, but by a system of special detectors. MSCT detectors are about 100 times more sensitive than X-ray film in detecting differences in primary beam attenuation. Primary beam attenuation is usually assigned a numerical value and is called the Hounsfield unit (HU). MSCT is calibrated so that the attenuation value of water is equal to 0, air to -1000. For bone structures, the attenuation value ranges from +800 and above. The density value for parenchymal tissues is 60-100 HU. MSCT allows you to simultaneously produce from 4 to 256 computer sections and, with the spiral movement of the X-ray tube, obtain an image of the entire body in a few seconds.

The obtained results were processed statistically according to Student-Fisher using the criteria for the reliability of differences in the compared indicators.

RESULTS AND DISCUSSION

As described above, MSCT examination of the lumbar spinal canal was performed in 35 patients without pathological changes, in whom the normal midsagittal and frontal dimensions of the bone border of the lumbar spinal canal, the vertical size of the intervertebral disc in frontal and lateral projections were measured. The sizes of the listed parameters are noted in Table 1 (numerator). The mid-sagittal and frontal dimensions of the spinal canal expand in the cranio-caudal direction: at the level L1=18.00±0.84 mm and 24.70±0.96 mm, at the level L5=21.31±0.86 mm and 30, 60±0.82 mm, respectively. At the same time, the frontal size of the levels of the spinal canal (from L1 to L5) turned out to be significantly wider ($P<0.05$) than its average sagittal size.

The vertical size of the intervertebral disc in frontal and lateral projections, cranio-caudal direction also significantly expand ($P<0.001$). The intervertebral disc was at the level of L1-L2=6.43±0.38 mm and 6.63±0.41 mm, at the level of L5-S1= 9.94±0.56 mm and 11.14±0.67 mm, respectively.

The midsagittal size of the bone border of the fifth (L5) lumbar spinal canal in comparison with L1 and L2 expands with a high degree of difference (from $P<0.05$ to $P<0.01$). Otherwise, the mean sagittal size of the spinal canal (L1<L2; L1<L3; L1<L4; L2<L3; L2<L4; L3<L4; L4<L5) is widened with a low degree of difference (from $P<0.8$ to $P<0.2$). The frontal size of the bony border of the spinal canal is widened with a high degree of difference ($P<0.05$) in comparison with the previous spinal canals, except for adjacent vertebrae, which are widened by an insignificant difference (from $P<0.8$ to $P<02$).

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

№	Parameters	Vertebral level				
		L1	L2	L3	L4	L5
1	Mean sagittal size of the bone border of the spinal canal	18,00±0,8418, 15±0.58	18,69±0.8118, 25±0,65	19,80±0.8716, 60±0,45	20,29±0.8615, 43±0,43	21,31±0.8614 ,55±0,37
2	Frontal size of the bone border of the spinal canal	24,70±0.96 24,60±0,67	26,00±0.89 24,90±0,56	27,49±0.91 25,55±0,50	29,00±0.86 26,15±0,46	30,60±0.8227 ,20±0,48
3	Vertical size of the intervertebral disc in direct 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 of the intervertebral disc in 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

When using MSCT to diagnose central stenosis of the spinal canal caused by degenerative diseases (protrusion and herniation of the disc) of the spine in 40 patients, as well as in healthy people, the following parameters were measured: the midsagittal and frontal dimensions of the lumbar spinal canal, the vertical size of the intervertebral disc in the straight and lateral projections (Table 1, denominator).

Comparing the pathological values of the parameters of the spinal canal with normal sizes, the following results were obtained: the midsagittal and frontal dimensions of the spinal canal in the affected areas (L3, L4, L5) of the spinal segment were significantly (from $P<0.05$ to $P<0.01$) shortened, while the midsagittal size of the spinal canal is more shortened than its frontal size. The 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 is also significantly (from $P<0.01$ to $P<0.001$) shortened. The vertical size of the IVD in direct and lateral projections in the affected areas in relation to the normal size of the spinal segment were shortened in percentage: at the level of L3-L4 by -20.9% and -24.8%; L4-L5 by -39.1% and -38.9%; L5-S1 by -43.5% and -44.7%, respectively, see Table 2.

Table 2: Degrees of difference (P) between normal (numerator) and pathological (denominator) CT values (in mm) of parameters of the lumbar spinal canal.

№	Vertebral level	Parameters			
		The mean sagittal size of the spinal canal	**Frontal size of the spinal canal**	**Vertical size of the intervertebral disc in direct projection**	**Vertical size of the intervertebral disc in lateral projection**
1.	L1	18,00±0,84 18,15±0.58 t= -0,15 P>0,8	24,69±0.96 24,60±0,67 t=0,07 P>0,8	6,43±0.38 6,05±0,31 t=0,77 P<0,8	6,63±0.41 6,18±0,24 t=0,96 P<0,8
2.	L2	18,69±0.81 18,25±0,65 t=0,42 P<0,8	26,00±0.89 24,90±0,56 t=1,05 P<0,8	8,57±0.42 7,48±0,28 t=2,17 P<0,05	7,71±0.45 6,80±0,27 t=1,73 P<0,1
3.	L3	19,80±0.87 16,60±0,45 t=3,27 P<0,01	27,49±0.91 25,55±0,50 t=1,86 P<0,1	9,00±0.49 7,13±0,30 t=3,25 P<0,01	8,94±0.56 7,05±0,22 t=3,16 P<0,01
4.	L4	20,29±0.86 15,43±0,43 t=5,05 P<0,001	29,00±0.86 26,15±0,46 t=2,92 P<0,05	9,89±0.52 6,03±0,29 t=6,52 P<0,001	10,09±0.60 6,38±0,24 t=5,48 P<0,001
5.	L5	21,31±0,86 14,55±0.37 t=7,22 P<0,001	30,60±0.82 27,20±0,48 t=3,58 P<0,01	9,94±0.56 5,63±0,25 t=7,02 P<0,001	11,14±0.67 6,70±0,27 t=6,12 P<0,001

To determine the severity of central spinal canal stenosis using MSCT, we focused on the detection of protrusions and disc herniation, their prevalence and location. Protrusions and herniations of the intervertebral disc are subdivided into local prolapse (up to 50% of the spinal canal circumference) and diffuse prolapse, when the disc bulges uniformly over 50% of the spinal canal circumference.

MSCT analysis of symptoms of degenerative lesions of the lumbar spine showed that disc herniations were single in 61.9% of patients, and multiple in 38.1% of patients, with 12.5% of patients having disc herniation in three or more vertebral segments.

Disc herniation by localization was distributed as follows.
diffuse prolapse of disc herniation into the spinal canal - 15.4% of patients;
local prolapse - 84.6% of patients.

Local disc herniations, in turn, were divided into unilateral - 85.8% of cases and bilateral - 14.2% of cases. In unilateral disc herniations, a left-sided paramedian variant was found in 39.4% of patients, a right-sided paramedian variant in 24.5% of patients, a left-sided posterolateral variant in 13.9% of patients, and a right-sided posterolateral variant in 8.0% of patients. In most cases, disc herniation occurred at the level of L4-L5=44.8% and at the level of L5-S1=35.4%, in other parts of the lumbar spine disc herniation was only in 19.8% of patients. Most often, disc herniations ranged from 4 to 9 mm in size, with the size of the disc herniation increasing in the cranio-caudal direction.

Thus, the ability to visualize degenerative changes in the lumbar spine suggests that MSCT is one of the main diagnostic methods for vertebrogenic and discogenic lesions, which can be used to accurately identify osteochondral and intracanal soft tissue pathological changes that are the cause of central stenosis of the lumbar spine. channel. MSCT has an advantage over plain radiography in studying the structural features of the spinal canal, the position and extent of the prolapsed disc, the causes of spinal cord compression, and the severity of degenerative processes in the intervertebral disc. However, the degree of MSCT visualization of intracanal soft tissue structures, including protrusions and herniated discs that cause central lumbar vertebral stenosis, is significantly inferior to the MR tomography method.

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