

Ultrasound Findings in Cervical Radiculopathy

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Abstract

Objective: The purpose of the study was to evaluate the possibilities of ultrasound in diagnosing the causes of cervical radiculopathy.

Materials and Methods: The analysis of ultrasound images of intervertebral discs in 68 adults aged 37-59 years with clinical signs of cervical radiculopathy was carried out. The study was carried out using ultrasonic device Philips HD-11; MRI - General Electric, Signa HDI, 1.5T.

Results: Among 68 patients with cervical radiculopathy 35 had posterolateral and 12 paramedial disc herniation, 21 had uncovertebral arthrosis with cervical osteophytes that compressed cervical nerve roots. Complete agreement between the results of MRI and USG in the diagnosis of disc herniation was noted in 44 (93.6%) cases, and in the diagnosis of uncovertebral arthrosis - in 19 (90.5%) cases.

Conclusion: USG is a cheap, informative method for diagnosing the causes of cervical radiculopathy and may be an alternative method to replace MRI in cases where the use of the latter is limited.

Keywords: Cervical Radiculopathy; Disc Herniation; Uncovertebral Arthrosis; Ultrasonography; MRI

Introduction

As you know, radiculopathy develops as a result of compression of the spinal nerves in the same names cervical nerve roots canals. The most constant clinical manifestations of cervical radiculopathy are pain, decreased reflexes, changes in the sensitivity of the fingers of the corresponding localization. For radiculopathy, the most characteristic is the unilateral irradiation of pain and loss of sensitivity in the hand. The decrease in reflexes often correlates with the results of surgical interventions [1]. In recent years, the prevalence of neck pain has increased significantly [2-4]. The main causes of cervical radiculopathy include degenerative changes in the discs, instability of the cervical vertebrae, uncovertebral arthrosis [5,6]. Cervical radiculopathy often develops with degenerative changes in the lower cervical intervertebral discs [7,8]. According to Nakki A., *et al.* (2014) in the development of cervical radiculopathy, an important role is played not so much by a disc herniation as by cervical spondylosis [9].

In the diagnosis of the causes of cervical radiculopathy, imaging methods such as anterior and lateral X-rays, computed tomography and magnetic resonance imaging play an important role [10,11].

Ultrasound is a non-invasive method that shows the structure of soft tissue components. Although ultrasonography has limitations in visualizing bone structures, it is used to investigate the causes of back pain, in evaluation of paravertebral ligament injuries in spinal fractures. Ultrasonography for cervical radiculopathy allow to measure the width of the spinal nerve roots [12]. The possibilities of ultrasonography in diagnosing changes in the intervertebral discs in cervical radiculopathy have not been studied enough.

Objective of the Study

The purpose of the study was to evaluate the possibilities of ultrasound in diagnosing the causes of cervical radiculopathy.

Materials and Methods

A retrospective analysis of the results of ultrasonography of the cervical spine was carried out in 68 patients who were clinically diagnosed with cervical radiculopathy. The age of the patients varied within 37-59 years, (the average age $45,7 \pm 6,8$), of which 42 (61.8%) were men and 26 (38.2%) were women. All of them complained of unilateral neck and scapular pain with irradiation to the arm, paraesthesias, numbness of the fingers and sensory disturbances, pathological reflexes in the arm of the affected side. In all patients, MRI revealed degenerative changes in the cervical spinal motion segments in the form of disc herniation or uncovertebral arthrosis. The comparison group consisted of 36 healthy volunteers without signs of cervical radiculopathy of the same age. Ultrasonography of the cervical spine held on the levels from C5-C6 to C7-Th1.

Ultrasonography was conducted on a Philips HD 11XE device using a microconvex (4 - 9 MHz) transducer, MRI - General Electric, Signa HDI, 1.5T.

Results

In healthy volunteers without degenerative changes of the intervertebral discs, the anterior dural space on the ultrasonogram looks like a hypo-anechogenous zone with even edges - the front contour of which is bordered by the posterior edge of the fibrous ring and the posterior edge by the anterior margin of the spinal cord. The spinal nerve canals are located on the posterolateral side of the intervertebral discs. Inside them, the spinal nerves are visualized as hyperechoic linear structures (Figure 1 and 2).

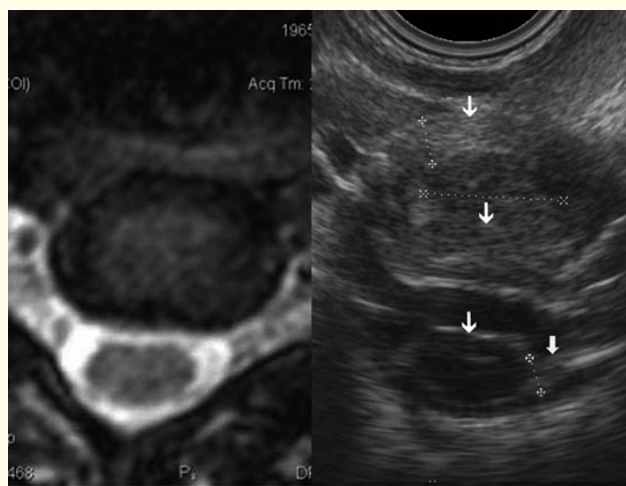


Figure 1: MRI and USG axial section of the intervertebral disc and spinal canal at the level of C5-C6. Top-down the vertical arrows show the fibrous ring, nucleus pulposus, spinal canal and spinal nerve root.

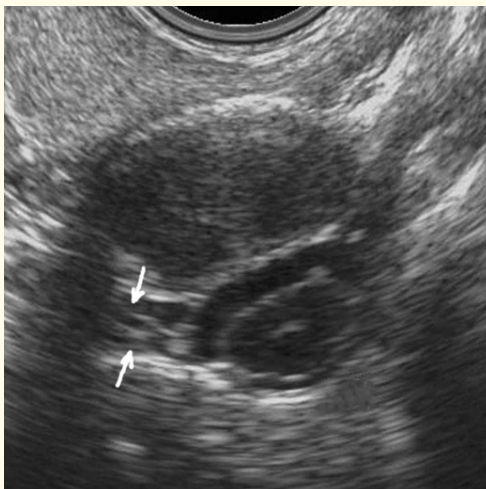


Figure 2: Axial section of the C6-C7. The arrows show the right spinal nerve canal.

As can be seen from table 1, cervical radiculopathy was caused by affected of the spinal motion segment at the level of C5-C6 in 7 (10.3 ± 3.7%) cases, C6-C7 in 35 (51.5 ± 6.1%) and C7-Th1 in 26 (38.2 ± 5.9%) cases, respectively. Based on MRI results in 5 (7.4 ± 3.1%) cases the hernia was localized at the level of C5-C6, in 24 (35.3 ± 5.8%) - at the level of C6-C7, in 18 (26.5 ± 5.4%) - C7-Th1, uncovertebral arthrosis - in 2 (2.9 ± 2.0%), in 11 (16.2 ± 45.8%) and in 8 (11.8 ± 3.9%) cases, respectively.

The affected level of IVD		Hernia	Uncovertebral arthrosis	Cervical radiculopathy
1	C5-C6	5 (7,4 ± 3,1%)	2 (2,9 ± 2,0%)	7 (10,3 ± 3,7%)
2	C6-C7	24 (35,3 ± 5,8%) P 2-1 < 0,001	11 (16,2 ± 4,5%) P 2-1 < 0,01	35 (51,5 ± 6,1%) P 2-1 < 0,001
3	C7-Th1	18 (26,5 ± 5,4%) P 3-1 < 0,01	8 (11,8 ± 3,9%) P 3-1 < 0,05	26 (38,2 ± 5,9%) P 2-1 < 0,001
Total		47 (69,1 ± 5,6%) P < 0,001	21 (30,9 ± 5,6%)	68 (100%)

Table 1: The affected level with a disc hernia and uncovertebral arthrosis by MRI in patients with cervical radiculopathy.

There was demonstrated, that the degenerative changes in the spinal motion segments C6-C7 and C7-Th1 cause cervical radiculopathy significantly more often (P < 0,001) than C5-C6. Disc herniation and uncovertebral arthrosis on MRI at the level of C6-C7 and C7-Th1 (P<0,01 and P<0,05) were diagnosed significantly more frequently than C5-C6.

Table 2 presents data on the comparison of the results of USG and MRI in the diagnosis of disc herniation, taking into account the level of its localization in the cervical spinal motion segment. As can be seen from the table, the results of the two methods coincided in 44 (93.6%) cases. At the level of C6-C7 in one case, at the level of C7-Th1 - in two cases with USG, the hernia was interpreted as a protrusion, but this did not affect the tactics of treating patients (Table 2).

The affected level of IVD	Hernia, n = 47	
	MRI	USG
C5-C6	5 (10,6 ± 4,5%)	5 (10,6 ± 4,5%)
C6-C7	24 (51,1 ± 7,3%)	23 (48,9 ± 7,3%)
C7-Th1	18 (38,3 ± 7,1%)	16 (34,0 ± 6,9%)

Table 2: The affected level of disc herniation in patients with cervical radiculopathy according to MRI and USG.

The results of MRI and USG, taking into account the localization of herniated discs inside the spinal canal, are presented in table 3. According to the localization of protrusion within the spinal canal, 3 types were identified: median, paramedian, and posterolateral. In one case, a paramedian hernia was interpreted by ultrasound as a median hernia, while at the same time, a hernia of this localization was not diagnosed by MRI. In two cases, the posterolateral hernia during USG was regarded as a protrusion. As can be seen from the table, the posterior-lateral hernia was the cause of cervical radiculopathy more often than the paramedian hernia (Figure 3).

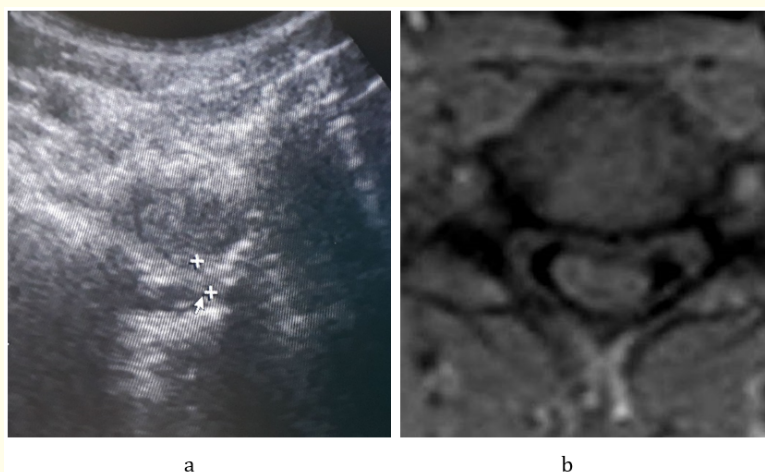


Figure 3a and 3b: Ultrasonographic (a) and MRI (b) view of a left-sided C6-C7 posterolateral hernia that is the cause of cervical radiculopathy.

№	The type of hernia	Hernia, n = 47	
		MRI	USG
1	Median	-	1 (2,1 ± 2,1%)
2	Paramedian	13 (27,7 ± 6,5%)	12 (25,5 ± 6,4%)
3	Posterolateral	34 (72,3 ± 6,5%) P 3-2<0,001	32 (68,1 ± 6,8%) P 3-2<0,001

Table 3: Localization of disc herniation inside the spinal canal in patients with cervical radiculopathy according to MRI and USG.

Comparison of the results of MRI and USG in the diagnosis of uncovertebral arthrosis is presented in table 4. As can be seen from the table, the results of the two methods coincided in 19 (90.5%) cases. Only in 2 cases at the level of C7-Th1 with USG, uncovertebral arthrosis was not diagnosed.

The affected level of IVD	Uncovertebral arthrosis, n = 21	
	MRI	USG
C5-C6	2 (9,5 ± 6,4%)	2 (9,5 ± 6,4%)
C6-C7	11 (52,4 ± 10,9%)	11 (52,4 ± 10,9%)
C7-Th1	8 (38,1 ± 9,7%)	6 (28,6 ± 9,9%)

Table 4: Ultrasonographic diagnosis of disc herniation detected by MRI in patients with cervical radiculopathy.

Discussion

Currently, MRI is the main diagnostic method of degenerative changes in intervertebral discs. It should be noted that high-frequency microconvex probes provide a high-quality image of the cervical motor segment of the spine. Some studies show high sensitivity and specificity of ultrasonography in the diagnosis of traumatic lesions of the spinal nerves [13]. Ikeda H., *et al.* (2012) described a case of formation of a herniated cervical intervertebral disc with stenosis of the spinal canal and the development of a symptom of myelopathy, which was eliminated by surgical placement [14]. The greatest decrease in the anterior-posterior dimensions of the spinal nerves canals occurs with posterior-lateral and paramedian hernias [15,16].

Magnetic resonance imaging is the most accurate method for diagnosing the different stages of osteochondrosis. It is proposed to carry out MRI with neck extension, which improves the visualization of the canal of the spinal nerve and to diagnose its stenosis [17,18]. But when using high-frequency microconvex transducer, the echographic image of intervertebral discs and the spinal canal is not inferior in quality to magnetic resonance imaging.

In the course of the study, it was found that the most frequently observed posterolateral 34 (72,3 ± 6,5%) hernias, which was the cause of cervical radiculopathy. Our research allowed us to demonstrate the possibilities of ultrasonography in assessing the structure of the cervical intervertebral discs in patient with cervical radiculopathy.

Conclusion

Ultrasonography is a cheap, informative method for diagnosing the causes of cervical radiculopathy and may be an alternative method to replace MRI in cases where the use of the latter is limited.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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