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Clinical Case

MAGNETIC-RESONANCE TOMOGRAPHY IN VALUATION OF VERTEBRAL-MEDULLARY CONFLICT IN METASTATIC COMPRESSION SPREAD FRACTURES

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Abstract

Magnetic-resonance tomography in valuation of vertebral-medullary conflict in metastatic compression spread fractures

***Objective**: to determine the vertebral-medullary conflict and its degree in patients with metastatic compression fractures and metastatic spine using MRI.*

***Material and methods:** The total examination of 50 patients with metastatic compression fractures of the spine was conducted. All patients underwent magnetic resonance imaging on devices with magnetic fields 0.2T, 0.36T and 1.5T. To assess the degree of involvement of the lumen spinal canal studied the degree of vertebral-medullary conflict: Grade I – compression of adipose tissue to the dural sac; Grade II– a slight deformation of the dural sac (25%); Grade III – compression of the dural sac up to ¼ the size of the dural sac (50%); IV Grade – compression of more than ¼ of the dural sac (over 50%).*

***Results:** Vertebral-medullary conflict Grade I at acute osteoporotic compression fractures was revealed in 10% of patients, II – in 28%, III - in 24% and IV – in 36% of patients. III and IV degrees of vertebral-medullary conflict constituted 60%, which was accompanied by a corresponding deficit of neurologic symptoms before the development of the paraparesis.*

***Conclusions:** 1. With metastatic compression fractures, the degree of vertebral-medullar conflict progressively increases, up to the complete compression of the vertebral channel (36%), compared with those in osteoporosis (7.4%).*

2. In pathological compression fractures of the spine, severe degrees of vertebral-medullar conflict are six times more often in metastatic fractures.

***Keywords:** metastatic compression vertebral fracture, vertebral-medullar conflict, osteopenia, osteoporosis.*

Introduction

Vertebral-medullary conflict (VMC) is a concussion, injury or compression of the spinal cord and its structures. The second most frequent cause of development of pathological compression fractures of the vertebrae is tumor lesion [*Spouziak R.M., 2002, Neledov D.V., 2010, Nered A.C., 2013*]. The urgency of this problem is confirmed by the data of Kassar-Pullichino VN. (2009): the incidence of paraplegia caused by neoplastic lesions of the spine is 8.5 per 100,000, while for spine trauma only 3 to 5 per 100,000.

In recent years, Ukraine has a clear tendency to increase the incidence of tumors of all major localizations. Ukraine and Russia (according to WHO) are among the world's top three leaders in cancer mortality per 100,000 population [*Sedakov I.E., 2013*].

In 2002, Spuziak R.M. proved that in patients with metastatic spine injury, the cause of the pain syndrome is not only destructive changes in

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vertebrae, but also spinal stenosis caused by pathological compression of the bodies of the affected vertebrae or the spread of the tumor process into the lumen of the spinal canal [*Spojak R.M., 2000; Shah L.M., 2011*]. The area of the spinal canal stably decreases with an increase in the degree of compression and explains the severity of the pain syndrome in pathological fractures of the vertebrae.

In connection with the improvement of surgical technologies and the introduction of vertebral- and kyphoplasty into the wide practice, we also evaluated vertebral-medullary conflict with the help of which it is possible to establish the degree of involvement of the lumen of the spinal canal.

The goal of the study is to determine the vertebral-medullary conflict and its degree in patients with metastatic compression fractures of the spine by using MRI.

Material and methods

For MRI diagnosis of VMC in patients with metastatic compression fractures (MCF), 50 patients were examined, among them 30 (60.0%) men and 20 (40.0%) women. The average age of these patients (60.8 ± 12.5 years) is comparable with the age of the control group.

All patients underwent MRI in 3 projections to obtain T1, T2-weighted images (WI), fat suppression images (STIR, Fat / Sat), and in mode 2 and 3D myelography.

The following localization of the metastatic compression fractures (MCF) in the departments of the spine has been established: cervical spine - 6 (12.0%) with solitary fractures; thoracic department - 25 (50,0%) with the presence of 18 solitary and 7 double fractures (total 32 fractures); lumbar - 19 (38%), among them 12 single and 7 double (total 26 fractures). In 47 (94%), multiple vertebral lesions occurred, which was an average value (2.45 ± 1.7). The conclusion about metastatic compression fractures (MCF) was given on the basis of anamnestic data and corresponding extracts from the case histories (outpatient card) - in 40 (80%) patients with known localization of the primary focus, in the remaining 10 (20%) - without the primary detected tumor.

To assess the degree of involvement of the lumen of the spinal canal, the degree of VMC was determined: Grade I - compression of fatty tissue to a dural sac; Grade II - insignificant compression and deformation of the dural sac (up to 25%); Grade III - moderate compression of the dural sac to ¼ the size of the dural sac (up to 50%); Grade IV - expressed compression of more than ¼ of the dural sac (more than 50%, Fig. 1).

Results and discussion

In our studies, the degree of metastatic compression fractures (MCF) was presented as follows (according to Dambacher [*Spouziak R.M., 2002*]): Grade I - 9 (18%); II - 5 (10%); III - 36 (72%).

Among the patients with Grade III fracture, explosive fractures prevailed - 19 (38%), and deformations included 7 (14%) fish-, 6 (12%) pancake-like and 4 (8%) wedge-shaped fractures.

Grade II (10%) was accompanied only by wedge deformation, and in 5 patients (10%) “fish”

Figure 1. *MRI in the sagittal plane of different patients with different pulse sequences, reflecting the degree of VMC. (**a**)-MRI of T2WI demonstrates Grade I; (**b**)-MRI 2D myelogram reflects the Grade II; (**c**)- post-contrast MRI T1WI illustrates the Grade III of compression; (**d, e**)-MRT 3D myelograms state the Grade IV of compression.*

a

was observed and wedge deformations occurred in 4 (8%) cases.

Due to various changes in the shape and degree of compression of the MCF, we first analyzed MRI data on VMC or the degree of canal stenosis, which has been studied so far by CT. At the same time, the VMC of different degree of severity was determined in 49 (98%) patients: Grade I -5 (10%); Grade II - 14 (28%); Grade III-12 (24%); IV-18 (36%).

In this case, III and IV - the Grade of VMC (the compression of the canal was 50% or more) was 60%, which was accompanied by a corresponding neurologic deficit up to the paraparesis. But if these changes were previously assessed only for CT scans, then with MRI it is possible to determine its degree with the help of 2D (3D) myelography regimes and, thus, affect the results of treatment of this category of patients. At the same time, the sensitivity of the III - IV VMC in the MCF was 98% with a specificity of 72.4% and almost 100% accuracy (99.7%).

As an example, observations with different degrees of VMC are given (Fig. 2).

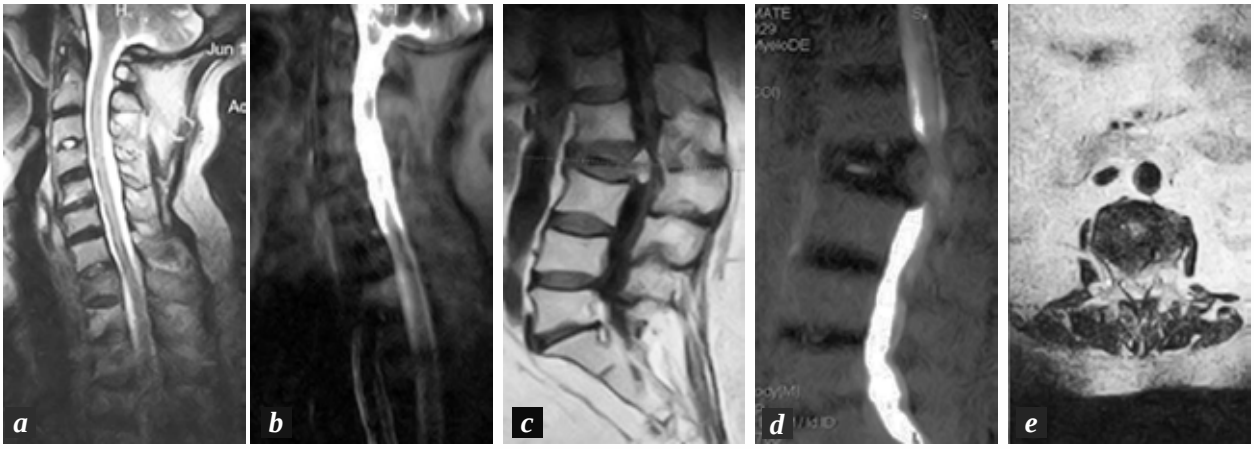

Figure 2. *MRI of the cervical and lumbar spine in the sagittal and axial planes of one patient with metastases of prostate cancer (T2WI and 2D myelography) illustrating the I degree of VMC (compression of the membranes) and the third degree of compression (within 50%).*

We have for the first time analyzed the MRI data on VMC or the degree of canal stenosis, studied so far by CT [*Shah L.M., 2011*]. At the same time, a different degree of VMC was determined in 49 (98%) patients with MCF: Grade I - 10%; Grade II - 28%; Grade III - 24%; Grade IV - (36%). These results explain the severity of the pain syndrome in this category of patients, which was caused by MCF of vertebral bodies and / or the spread of the tumor process into the lumen of the spinal canal. So, III and IV degrees of VMC constituted 60%, which was accompanied by a corresponding deficit of neurological symptoms up to paraparesis. At the same time, the sensitivity of Grade III-IV VMC with MCF was 98% with a specificity of 72.4 and almost 100% accuracy (99.7%).

Our researches confirm the existing point of view that the channel lumen decreases correspondingly to the increasing degree of its compression [*Shah L.M., 2011*]. But if these changes were evaluated only on CT, then with MRI it is possible to determine its degree with the help of 2D (3D) myelography regimes and, thus, affect the results of treatment of this category of patients.

Conclusions

1. In metastatic compression fractures, the degree of vertebral-medullary conflict is progressively increased according to MRI data, up to a complete compression of the channel lumen (36%), compared with those in osteoporosis (7.4%).

2. In pathological compression fractures of the spine, severe degrees of vertebral-medullary conflict are six times more common in metastatic fractures.

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