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Outcome of surgical treatment of secondary spinal canal stenosis due to intervertebral disc herniation. (hospital)

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Abstract: This article analyzes the results of surgical treatment of a 61-year-old patient named M., who had VC3-4 (3.0mm), VC4-5 (3mm), VC5-6 (3mm), VC6-7 (3.0mm) intervertebral disc herniation, which involved removal of all intervertebral discs in the cervical spine and implantation of a "PEEK" cage implant. The extent to which the dynamics of clinical and neurological symptoms changed 3 months after the operation, the general clinical neurological condition of the patient, and changes in the range of motion in the arms and legs were recorded.

Keywords: instability, tracts, decompression, stabilization, MESH-system.

Introduction

Spinal disc herniations are one of the most pressing problems in neurosurgery, traumatology, and neurorehabilitation, and this is explained by the many complications associated with long-term damage to the spinal cord, severe functional impairments in patients' ability to serve themselves, control the activities of the limbs and pelvic organs, high disability rates, and the complexity of the social and psychological adaptation of patients.

Herniated discs and spinal cord compression account for 15–30–42% of all spinal diseases [1, 13]. In large industrial cities of Russia (St. Petersburg, Nizhny Novgorod, Irkutsk), the incidence of herniated discs and spinal cord compression is 5.58–7.6 cases per 10,000 population [5, 7, 10], in Kazakhstan – 4.3 cases [1], and in Ukraine – 6.4 cases [13].

According to Murphy KP [14], the incidence of herniated discs and long-term spinal cord injury in the United States is 0.2–0.5 cases per 10,000 population. In Russia, the number of cases of herniated discs and spinal cord compression increases by 8,000 annually. In the United States, 10,000 new cases of herniated discs and spinal cord compression are registered annually [2, 14].

80% of cases of herniated discs and spinal cord compression are observed in relatively young people aged 42 to 58 years, and this figure is currently increasing every year [4, 8, 9], and the incidence of herniated discs in middle-aged people (15–19 years) is 0.67 per 10,000 population [11], and in people under 29 years old it is 1.9 per 10,000 population [10], and this figure is increasing every year. The disability rate after herniated discs and spinal cord compression ranges from 25.5% to 56%, and sometimes this figure reaches 82% [3, 7, 12], and this constitutes 0.5% of the total disabled population [6].

Comments: In the case of a clinical case, the results of surgical treatment of VC3-4 (3.0mm), VC4-5 (3mm), VC5-6 (3mm), VC6-7 (3.0mm) intervertebral disc herniation, removal of all intervertebral discs in the cervical spine and replacement with a "PEEK" cage implant, were analyzed.

Materials and methods of the study: The results of clinical-neurological,

neuroradiological (spondylography, multispiral computed tomography, magnetic resonance imaging, magnetic resonance tractography), and neurophysiological (electroneuromyography) examinations of a 61-year-old patient named M., who underwent surgical treatment with the diagnosis of "Strongly expressed osteochondrosis of the cervical and upper thoracic spine, spondyloarthrosis. VC3-4 (3.0mm), VC4-5 (3mm), VC5-6 (3mm), VC6-7 (3.0mm) intervertebral disc herniation. Protrusion of the posterior longitudinal ligament. Stenosis. Brachioplexalgia (more on the left). With vertebrobasilar syndrome" before and after treatment were analyzed.

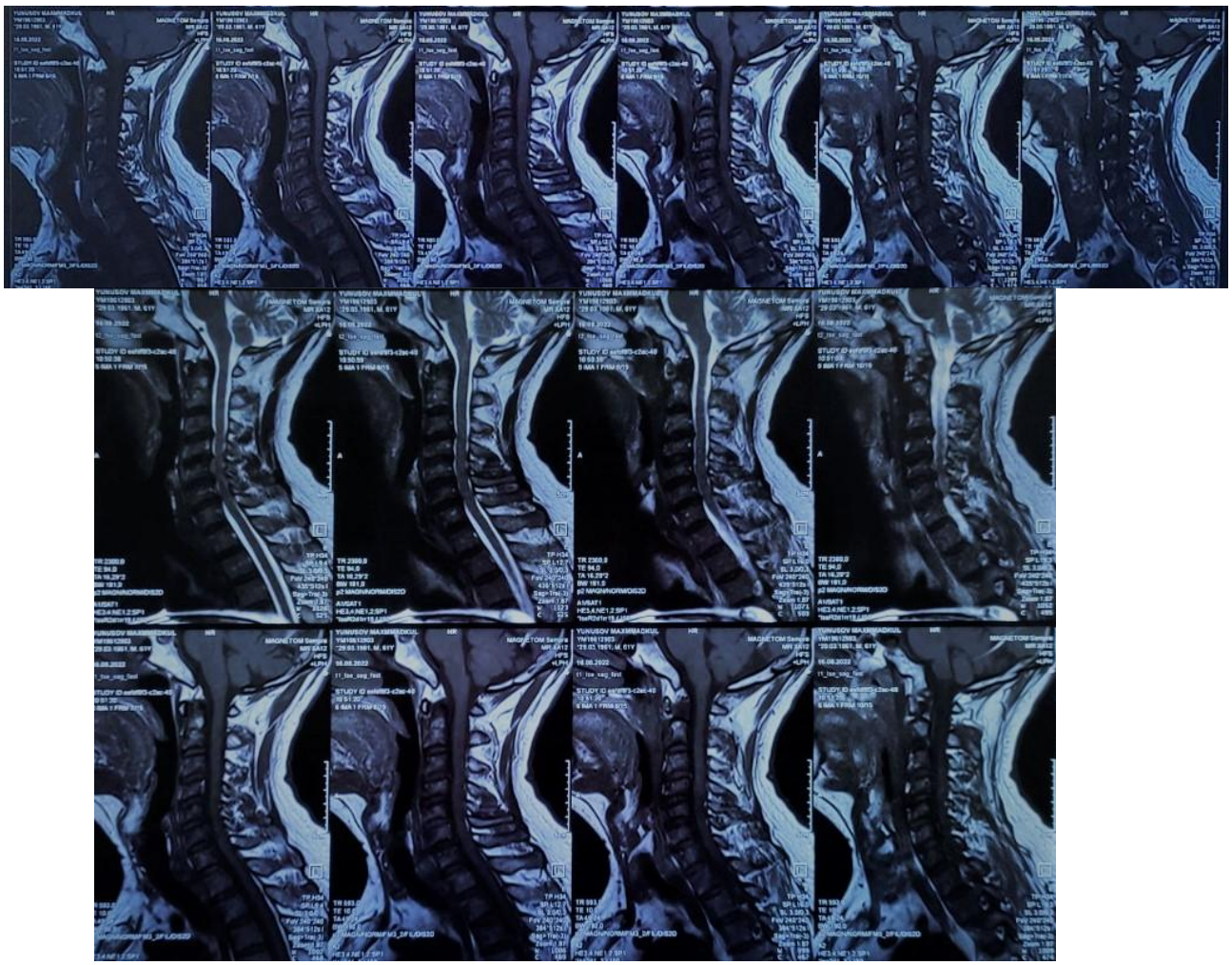
The results of the study and their discussion: The patient came to the neurosurgery department of the SamDTU Multidisciplinary Clinic complaining of decreased range of motion in his arms and legs, constipation, difficulty breathing, abdominal distension, general malaise, and difficulty walking and sitting.

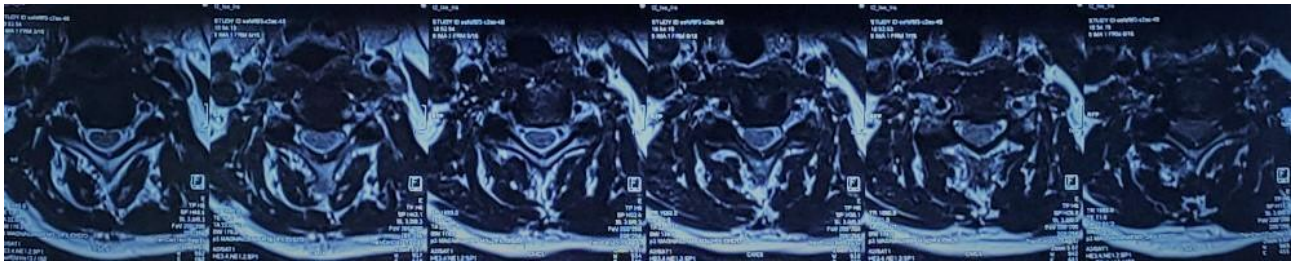
History of illnessWhen examined, the patient states that he considers himself sick since March 2022 and associates his illness with his profession, that is, welding metals while bending for a long time. The patient began with a feeling of numbness in his arms and legs, and the range of motion gradually decreased. The patient was in danger and received conservative treatment at home under the supervision of neuropathologists, various ointments and herbs under the supervision of doctors, manual, massage, and other treatments under the supervision of physiotherapists. However, no positive changes were observed in the patient. Due to the intensification of the patient's complaints, he applied to the neurosurgery department of the SamDTU multidisciplinary clinic, and based on the conclusions and complaints of additional examinations (MRI, MSKT, ENMG), he was hospitalized in the neurosurgery department for examination and operative treatment.

At the time of admission to the clinic, an objective examination revealed that the patient's general condition was relatively severe, the skin was fluid, the subcutaneous fat layer was poorly developed for his age, he was breathing independently, and faint vesicular breathing was heard from his lungs. Heart tones were muffled. Pulse rate was 80 beats per minute. ABP was 110/70 mm. cm. above. Appetite was poor. His bowel movements were disturbed by constipation.

On clinical and neurological examinationMental status – clear, answers questions, general brain symptoms are determined. Orientation to time and place is not impaired. Mood is changeable, depressed. Cranial nerve activity: I pair of nerves – sense of smell is not impaired; II pair – visual acuity and visual field are the same in both eyes, preserved; III, IV and VI pairs – eyeball movement is not limited, squinting is not observed, pupils are D=S, photoreaction is preserved; V pair – the places of exit of the trigeminal nerve to the skin are painless, the masticatory muscles are symmetrically developed; VII pair – the face is symmetrical; VIII pair – hearing is not impaired; IX, X pairs – the soft palate is symmetrical, the uvula is centrally located; XI pair – shoulder elevation is not limited, turning the head to both sides is the same, not limited; XII pair – the tongue is in the midline.Skin sensation is impaired in the form of conductive hypesthesia starting from the VC3-4-5-6 nerve segments. Spastic tetrasyndrome (lower paraplegia in the legs, deep upper paraparesis in the arms) is detected. Sometimes he pulls his legs together due to spinal automatism. He tries to raise both shoulders (proximal muscle movement is relatively preserved). Signs of hypotrophy are detected in the muscles of the arms and legs. Tendon reflexes are enhanced on both sides (hyperreflexia), muscle hypertonus is detected. The function of the pelvic organs is impaired in the form of seizures in the central type, erection and ejaculation function are lost.

Additional test results:VC3-4 (3.0mm), VC4-5 (3mm), VC5-6 (3mm), VC6-7(3.0mm) intervertebral disc herniation. Posterior longitudinal ligament prolapse. Compression of the spinal cord, nerve roots and dural sac.





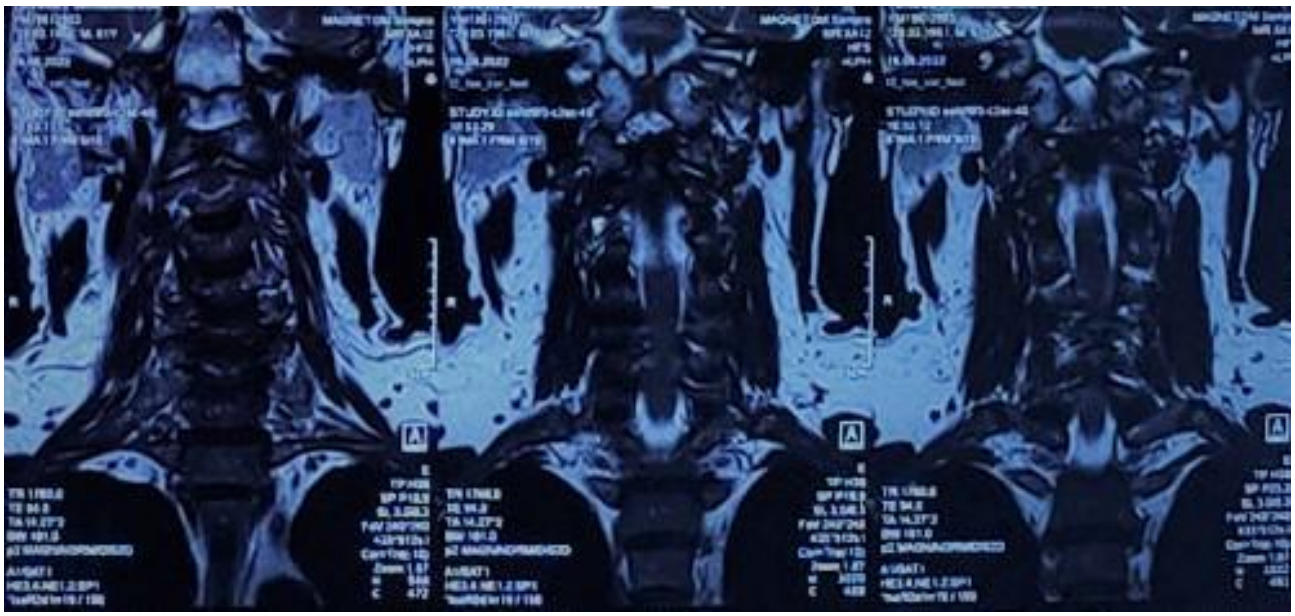


Figure 2. Patient M., August 26, 2022. Magnetic resonance imaging (A. sagittal section, T2 mode; B. sagittal section, T1 mode; S. axial section, T2 mode; D. coronal section, T2 mode) revealed intervertebral disc herniation in VC3-4 (3.0mm), VC4-5 (3mm), VC5-6 (3mm), VC6-7(3.0mm) due to intervertebral disc herniation.

ENT conclusion: Deviated nasal septum; Therapist conclusion: Chronic gastroduodenitis; Anesthesiologist conclusion: No contraindications to anesthesia were identified; ECG conclusion: No pathological changes were detected; Chest X-ray and MSCT examination: No pathological signs were detected; MRI of the neck: VSA, NSA, OSA, left brachiocephalic trunk in good condition. Carotid buffering in the spine.

Laboratory report:General blood test: Hemoglobin-110.0 g/l, leukocytes 5.6; ESR-38 mm/h; erythrocytes-4.0; lymphocytes-29%, monocytes-2%. Blood clotting time according to Sukharev: started - 2 minutes 25 sec, finished - 4 minutes 20 sec. General urine test: Volume-100.0 ml; color - straw yellow; clarity - cloudy; relative density - 1015; protein-no; epithelium - ; leukocytes - 4-3-5; erythrocytes - no; from salts - oxalates are detected; bacteria - ; mucus - detected in large quantities. Biochemical blood tests: Bilirubin – 10.9; AST – 0.26; ALT – 0.52; creatinine – 73.2; urea – 5.8; blood sugar level – 5.81 mmol/l. Blood coagulation system parameters: Venous blood clotting time (according to Fonio): started - 3:09; ended - 4:13; prothrombin time - 16 seconds; prothrombin index - 100%; INR - 1.00. Blood group and Rh factor: V(III), Rh - (negative). Blood test for Hbs Ag and HCV Ag (IFA): Negative. Wasserman reaction: RW - negative.

The patient was clinically discussed in the clinic and operative treatment was recommended.

Treatment:The patient was prepared in the department as planned, and on August 26, 2022, the operation “Removal of herniated disc between VC3-4, VC4-5, VC5-6, VC6-7 by ventral method, implantation of intervertebral “PEEK” cage.” (Operation No. 259) was performed. Under general endotracheal anesthesia, on the front surface of the neck, the skin and subcutaneous soft tissues were cut along the medial edge of the muscle in the middle third of the right sternocleidomastoideus muscle for a length of 4.5 cm. The fascia of the muscles in this area, the platysma muscle, was cut open. The deep muscle group of the neck was separated bluntly. The paravertebral and posterior tracheal fibers were prepared, and the ventral surface of the bodies of the VC3-4, VC4-5, VC5-6, VC6-7 vertebrae was skeletonized. During revision, it was

found that coarse osteophytes had formed in this area. After being identified using EOP, this secondary degeneratively altered annulus fibrosus and nucleus pulposus (disc) were discectomy. During revision, herniated disc components and secondary altered posterior longitudinal ligament into the anterior and lateral chambers of the spinal canal were identified and carefully separated and removed using special instruments. The compression of the spinal cord and roots in this area was completely decompressed. Hemostasis. In the next stage of the operation, a Kaspar wound expansion device was installed on the bodies of VC2 and VC7, and a PEEK (poly-ether-ether-ketone) cage (Figure 4) was implanted in the area where the disc was removed between VC3-4, VC4-5, VC5-6, VC6-7. After confirming the satisfactory implantation of the cage using EOP, a rubber drain was left in the wound area and closed with layer-by-layer sutures. The wound was treated with iodine, an alcohol compress and an aseptic bandage were applied. In the next stage of the operation, the "PLAT-system" (Figure 5) was implanted into the VC4-VC7 vertebral bodies.

Figure 4. PEEK cage implant acting as an intervertebral disc.

Figure 5. PEEK cage placement was monitored using EOP performed during surgery.

Figure 6. Implant for pre-fixation of vertebral bodies – Plate-system.

Figure 7. Spinal stabilization, spinal canal decompression, Plate-system fixation, confirmed using EOP performed intraoperatively.

A titanium plate-"Plat" was installed on the anterior surface of the VC4 and VC7 bodies and fixed with four screws (Figure 6), and the anterior and middle supporting columns of the cervical spine were stabilized.

After confirming the satisfactory implantation of the implants using EOP (Figure 7), a rubber drain was placed in the wound area and the wound was closed with layer-by-layer sutures. The wound was treated with iodine, an alcohol compress, and an aseptic dressing were applied. The patient was treated in the ward with calcium preparations, methylprednisolone, antibiotics, vitamin B group, and neuromidine.

Objective status at the time of response:The general condition is moderate. Breathing is free. Hemodynamic indicators are stable. Pulse is 78 beats per minute. ABP is 120/80 mm Hg. The activity of internal organs is moderate. Appetite has improved. Urinary function has recovered.

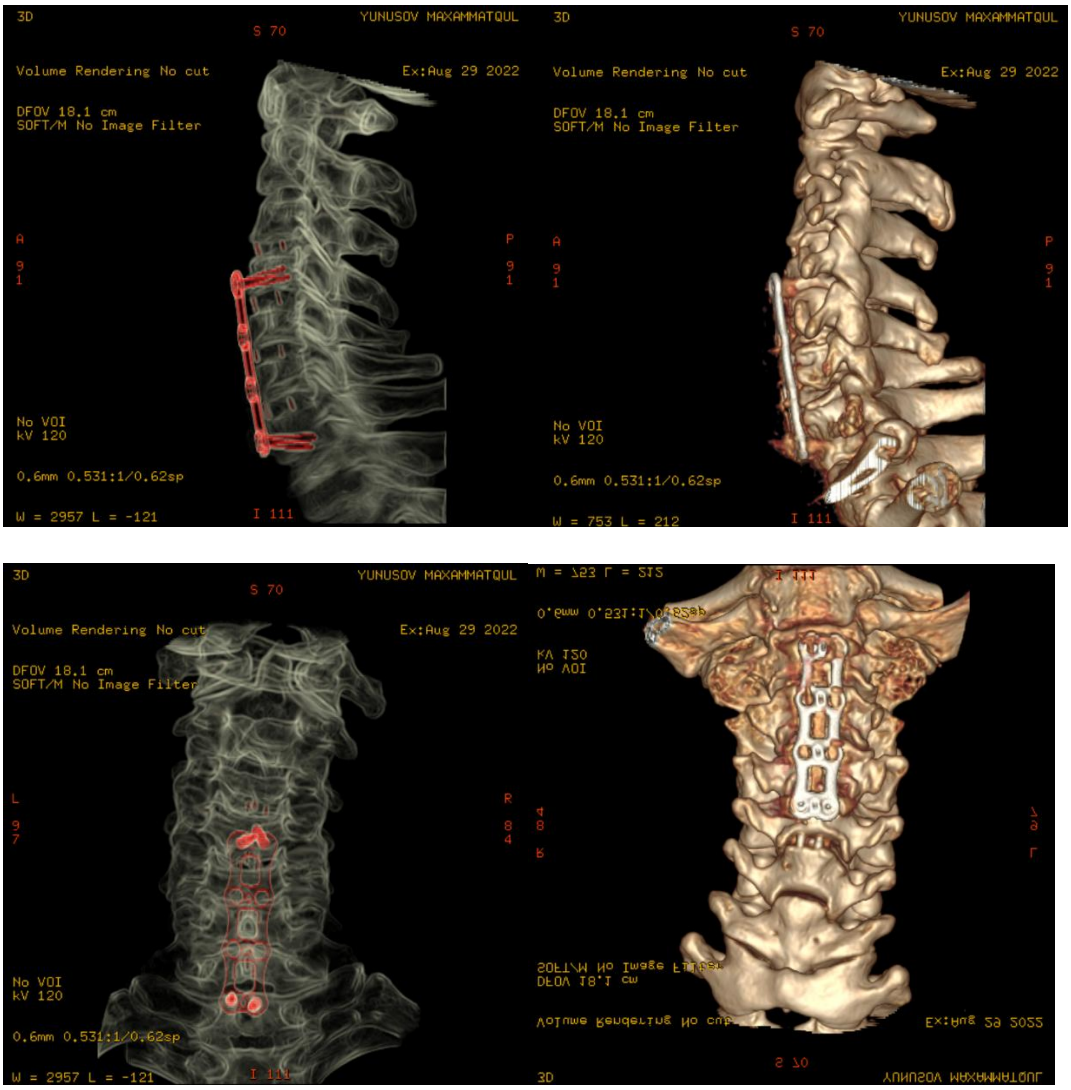
Neurological status in response:The movement in his hands became relatively active,

the sensation in his legs improved. His mood improved. The surgical wound healed. The stitches were removed. The patient was discharged home in satisfactory condition.

During the post-mortem clinical and neurological examination of the patient, it was determined that skin sensation hypoesthesia had improved, spasticity had decreased, tetrasyndrome - lower paraplegia in the legs to deep paraparesis (he raises, retracts, extends his leg); deep upper paraparesis in the arms to superficial paraparesis had recovered. Sometimes spinal automatism was not observed. The ability to raise both shoulders was not impaired, lung excursion was restored, and muscle trophism in the arms and legs improved. Hyperreflexia in the tendon reflexes was reduced, and muscle hypertonia was reduced. The function of the pelvic organs was impaired in the form of seizures in the central type, the bladder and rectum felt full, erection and ejaculation were restored, the patient was able to hold his neck and sit independently.

Additional test results:Multispiral computed tomography of the cervical vertebrae (Figure 8) and spondylography (Figure 9) showed satisfactory stability of the implants and the spine, complete resolution of secondary stenosis of the spinal canal, and decompression of the spinal cord. Electroneuromyography confirmed a relative decrease in the blockade in the cervical region, and activation of impulse conduction.

Conclusion: As a result of analyzing the clinical situation, the following conclusions can be drawn:



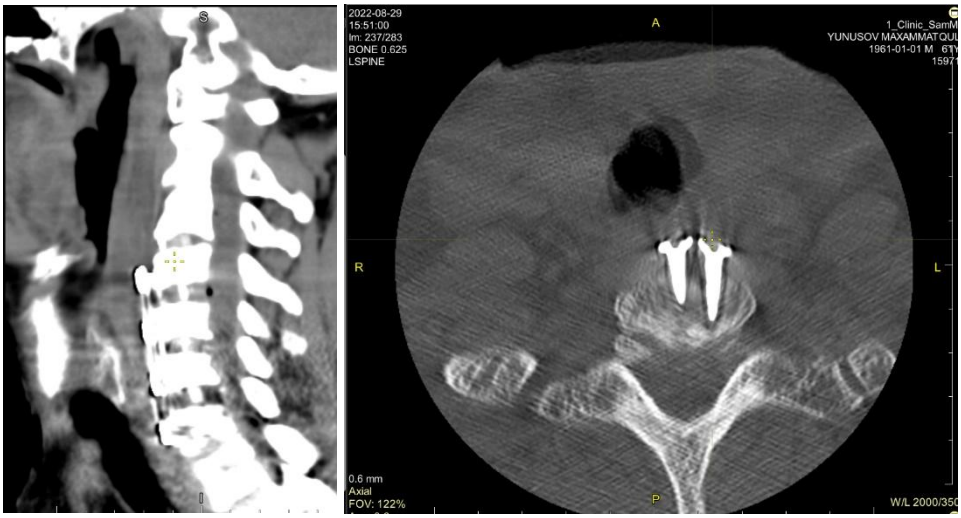


Figure 9. Patient M. August 29, 2022. Multispiral computed tomography of the cervical vertebrae. Stabilization of instability of the cervical spine, complete decompression of the spinal canal, satisfactory fixation with PEEK cage and Plate system, 1 week after surgery.

- In traumas of the cervical spine and spinal cord, in addition to clinical and neurological examinations, it is possible to objectively assess the organic state of the spinal cord tracts using magnetic resonance imaging, multispiral computed tomography, spondylography, and magnetic resonance tractography, which is a modern additional program of MRI.

- This, in turn, is of great importance in correctly choosing the appropriate type and extent of surgical operation for this type of patient.

- Even in the intermediate and late stages of cervical spine and spinal cord trauma, if it is confirmed that the conduction pathways in the spinal cord are partially preserved, reconstructive operations involving decompression and stabilization can lead to a positive regression of the patient's clinical and neurological function.

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