**POSTERIOR INTERBODY SPONDYLODESIS WITH CAGE IN THE SYSTEM OF LUMBAR OSTEOCHONDROSIS TREATMENT**

Titanic cage in combination with autobone can be used successfully for the different types of interbody spondilodesis additionally to the other known implants. Owing to the holes located in the corpus of titanic cage there is contact between autobone and osseous tissue of the adjacent vertebrae. The favorable conditions have been created for formation of bone-metallic spondylodesis. The application of titanium cage has reduced traumatic effect of operation and has not required additional use of autobone tissue from the iliac crest.

**Keywords:** Titanic cage, spondilodesis, osteochondrosis, autobone

**UDC:** 616.721.018.3-089.844

**Introduction**

The surgical treatment of various forms of lumbar osteochondrosis, for example, associations of instability of a segment with intervertebral disk herniation or degenerative stenosis, or vertebral spondylolisthesis, remain to be serious problem of the operative vertebrology (Grunтовский, 1992; Vetrile, Shvets, and Krupatkin, 2004; Simonovich, 2004; Agazzi, Reverdin, and May, 1999; Caputy and Luessenhop, 1992).

A variety of clinical and pathomorphological manifestations of the degenerative spinal changes dictate necessity of differential approach to treatment of this pathology. Such approach should be based on principles of clinical-morphological conformity to the minimal surgical sufficiency (Бизюков and Дуров, 1998; Зилберштейн, 1999; Кхвисюк, 1976; Умашев, Капанадзе, and Elizarov, 1992; Kanayama, Cunningham, Haggerty et al., 2000). For elimination of the pathological conditions at this time there are applied various types of decompressive and decompressive-stabilizing interventions. There are anterior, posterior, posterior interbody and other types of spondylodesis (Дулаев, Ястребков, and Орлов, 2000; Markov, Vlasov and Voloshin, 2002; Brantigan, 2000; Cloward, 1963; Liu, Ondra, and Angelos, 2002).

Because of great development and improvement of medical technologies the anterior spondylodesis concedes the place on back (Гутер, Дамбаев et al., 1998; Agazzi et al., 1999; Elias, Simmons, and Kaptain, 2000; Kettler, Wilke, Dietl et al., 2000; Klemme, Owens et al., 2001). The anterior spondylodesis according to the data of literature is known by its multiple complications (Кхвисюк, 1976; Умашев et al., 1992).

The autobone, metal implants, ceramics, biopolymers and others are frequently used as plastic material. Because of slow autobone reorganization the long postoperative bed regimen is required (Гутер et al., 1998; Eliseev and Brekhov, 1998; Ratkin, Lucik et al., 2004).

The various implants made from titanium have been developed and manufactured by foreign firms for interbody spondylodesis (Bagby, 1998). However, in any case these materials are foreign bodies and they are unable to be integrated with the body tissues. In order to preserve the achieved intervertebral intervals and to improve the quality of spondylodesis the metal implants should be combined with autobone.

The purpose of our research was to develop the native titanium implant for performance of the posterior interbody spondylodesis in combination with autobone at various types of decompressive-stabilizing operations for treatment of lumbar osteochondrosis.
Material and methods

In the beginning of 2007 together with Joint Stock of the air factory after V.P.Chkalov there was developed titanium implant for posterior interbody spondylodesis. In 2008 the Patent for useful model “The Device for treatment of damages and diseases of the spine” No.(11) FAP 00398, (51) 8A61B 17/58, (21) FAP 2008 0005 from 22.01.2008 was received.

The device for treatment of degenerative spinal lesions was made as hollow body from titanium alloy 1, one end of which has the form of cone 2, on the surface of device there is a groove 3, in the central part of the device there are holes of quadrangular form 4, in the middle of the opposite end there is a deepening of quadrangular form 5 and four holes 6.

The device is used as follows. After detection of a zone of damage the affected site has been removed, the bed has been prepared for placement of the offered device with use of special crown mill in bodies of top and lower vertebrae. The device is placed in the previously prepared bed. One end of cone form (2) is introduced into this bed. On the opposite end into the deepening of quadrangular form (5) the key of tetrahedral form is inserted for the device (1) with groove (3) and cone (2) to be screwed into the intervertebral interval. Through holes (6) the cavity of device is filled with bone fragments.

During the period from 2008 to 2010 the operations with use of titanium implants for posterior interbody spondylodesis in combination with autobone were performed in 32 patients with diagnosis of lumbar osteochondrosis. Among them there were 13 (40.6%) males, and 19 (59.4%) females. The age of patients fluctuated from 18 till 61 years (average age 39.5 years). In the preoperative period there were performed common clinical, neurological, roentgenological, MRI, CT and MSCT investigations.

The indications for operative treatment were clinically important pathomorphological changes in the spine including intervertebral disk hernia, degenerative spinal canal stenosis, instability of the spinal segment, degenerative spondylolisthesis, pain syndrome recurrence after extended decompressive operations. The decompressive-stabilizing operations with interbody spondylolisthesis were performed from the posterior approach at the following levels: VL4-VL5- at 15 (46.8%), VL5-VS1 -y 14 (43.75%), VL1-VL2- at 1 (3.1%) and VL4-VL5-VS1- at 2 (6.25%).

The posterior lumbar interbody spondylolisthesis may be divided schematically into the following stages: 1 - surgical access, 2 - decompression of the nervous-vascular sites and autobone isolation from the vertebral arch, 3 - bed formation for titanium cage and implant cavity filling with autobone, 4 - cage insertion into the interbody interval, 5 - suture of the surgical wound.
We agree with opinion of Simonovich (2005), that laminectomy with removal of the osseous and articular processes for formation of posterior interbody spondylodesis is not always justified. For performance of the posterior interbody spondylodesis the extended interlaminectomy with saving resection of the arch and articular process margins has been quite sufficient.

The implant height for implant is usually less than the cage size or height. On the average the cage diameter is from 16 up to 18 mm. The implant screwing results in increase of intervertebral space and, consequently, appearance of opening effect with wedge of interbody cage. The posterior interbody spondylodesis in combination with transpedicular fixing was performed in 13 patients with establishment of expressed instability and lumbar segment degenerative spondylolisthesis.

**Figure 2. The findings of the radiological methods of investigation of patient E**

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
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In 19 cases the posterior interbody spondylodesis was performed with use two titanium cages.
Figure 3. The findings of the radiological methods of investigations of patient P.

a, b - functional spondylogram, discogenic instability at a level VL4-VL5; c - MRI, protrusion of a disk VL4-VL5 and stenosis of the spinal canal; d, e - state after posterior interbody spondylodesis with cages one year later.

The bed regimen after operation lasted from 2 to 5 days, and then the patients were permitted to walk. The external mobilization was provided with use of semi-hard corset during 3 months after operation.

The results of surgical treatment have been studied in 24 patients 3-6 months after operation and in 21 patients in 12-24 months.

For evaluation of the impaired functional ability the Oswestry Disability Index was measured on a scale from 0 up to 100 %. The scores from 0 up to 20% mean the minimal disorders, from 21 to 40% - moderate, from 41 to 60% - heavy, from 61 to 80% - disability; 81 up to 100% indicated about disorders arresting on bed. Formation of interbody block after spondylodesis was analyzed on the basis of parameters of roentgenographs, CT and MSCT. Roentgenographic parameters included posterior and anterior segments of interbody intervals before and after operation, as well as flexion-extension difference of the segmentary angle at a level of surgical intervention. The change of the segmentary angle value at the position of flexion and extension by less than 5° was evaluated as confirmation of the stable spine segment and formation of interbody block. Before operation all the patients were measured horizontal mobility 8.1±1.3 mm, and segmentary angle was more than 5°.

Results

The majority of patients felt sharp reduction of pain in the lumbar spine and lower extremities the next day after operation. Nobody of the patients there was noted increase
in pain syndrome that indicated about adequate decompression of nervous-vascular masses and stabilization of vertebral-motor segment. Regress of the pain syndrome were evaluated by 5 score visual - analog scale (VAS), it is shown in Table 1. Dynamics of Oswestry Index after performance of surgical intervention is presented in Table 2.

**TABLE 1. DYNAMICS OF THE PAIN SYNDROME INTENSITY BY VAS AFTER OPERATION**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Before operation</th>
<th>Pain syndrome intensity by VAS from 0 to 5 scores</th>
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<tr>
<td></td>
<td></td>
<td>3</td>
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<tr>
<td>Posterior lumbar interbody spondylodesis with use of cage</td>
<td>4.8±0.5 (n=32)</td>
<td>1.7±0.2 (n=24)</td>
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**TABLE 2. DYNAMICS OF THE OSWESTRY DISABILITY INDEX (ODI) AFTER SURGICAL INTERVENTION**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Before operation</th>
<th>Dynamics of the ODI in operated patients</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Posterior lumbar interbody spondylodesis with use of cage</td>
<td>68.27±7.59 (n=32)</td>
<td>19.37±7.18 (n=24)</td>
</tr>
</tbody>
</table>

All patients underwent postoperative roentgenological, CT and MSCT examinations. Roentgenological investigations did not show implants destruction and signs of bone resorption around implant in the vertebra body in any case. The flexion-extension difference of the segmentary angle at the level of intervention was measured on the basis of roentgenological parameters. The data received indicated that an average parameter of segmentary angle at the level of intervention was not higher than 5° and was on the average 2.3±0.3°.

The data of CT and MSCT investigations performed during the period from 12 months to 2 years indicated about implant stabilizing ability with formation of interbody bone-metallic block at the place of intervention.

Postoperative complications we divided into intraoperative and postoperative. Intraoperative period was characterized by frequent hemorrhages from varicose epidural veins in 8 patients. The hemorrhage was stopped by tamponade with use of hydrogen peroxide and very seldom with electrocoagulation. The partial damage of the dural sac was noted in 2 patients. This complication occurs during decompression of the degenerative changed spinal canal with use of the tool “Kerrinson”, then parietal dural sac was damaged. The damaged site of the dural sac was closed by superficial flap from dorsolumbar fascia.

In the postoperative period there was no inflammatory process in any patient. It is explained to that we used antibacterial agents of the wide spectrum of action before and during surgical interventions.
The received results of surgical intervention we estimated with regards of a degree of physical and social activity recovery of the patients. The criteria for estimation of the results of treatment were the following:

- Good result: complete or nearly complete returning to the former levels of social and physical activity.
- Satisfactory result: social and physical activity are restored not completely, small physical loadings are possible only.
- Unsatisfactory result: absence of effect from operation or deterioration of health state.

The long-term postoperative results were studied in 18 patients. The results obtained were assessed as good in 25 patients, and satisfactory results in 7 patients. One patient had unsatisfactory result. She underwent surgical interventions in the neurosurgical department in various hospitals in the republic. After decompressive-stabilizing operation in our clinic neurological parameters of the lower extremities were decreased a little, but
during 6 months she is walking with the help of crutches. Because of rough scary-adhesive changes in the spinal canal the reparative processes are slow.

The results of posterior interbody spondylodesis with use of titanium cage in combination with autobone depended on the correct choice of surgical technique and adequacy of surgical intervention, directed to decompression of nervous - vascular formations and stabilization of spinal segment. High positive parameters indicated that titanium cages in a combination with autobone are quite met to many criteria being required from plastic material for stabilization of the spinal segment.

Roentgenological and MSCT investigations have not revealed destruction of the interbody cages and their migration into vertebra. It was noted coating of the cage internal autobone with osseous tissue from adjacent vertebra with formation of the bone-metallic block. In all cases the operated spinal segments were stable. Besides the application of titanium cage resulted in decrease of traumatic operation effect and did not require additional use of auto-osseous tissue from the crest of the iliac bone.

**Conclusion**

The titanium cages in a combination with autobone may be successfully used for various types of interbody spondylodesis additionally to the other famous implants. Because of holes in the titanium cage body there is a contact between autobone and osseous tissue of the adjacent vertebra. The favourable conditions have been created for formation of bone-metallic spondylodesis. The application of titanium cage has reduced traumatic effect of operation and has not required additional use of autobone tissue from the iliac crest.

**References**


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