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# The Influence of Instability on the Tactics and Results of Degenerative Disc Disease Treatment

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The aim of the work was to evaluate the influence of instability on degenerative disc disease and to determine prognostic criteria for effective treatment. From 483 examined and treated patients instability was found in 47% of cases. The symptoms of this group were similar to those in the control group with macroinstability. Spondylosis, vertical (disc collapse) and horizontal microinstability and double vertebral body outline in CT scan were determined as the main symptoms of microinstability. They allow to diagnose instability in 88% of cases of degenerative disc disease when there is no obvious nerve root compression. The influence of surgical tactics and instability on the results of different cases of disease was established. The treatment was not effective in 17% of operated on and 67% of non-operated patients. The best results were achieved in the treatment of disc herniation. They depended on the absence of instability and surgical treatment. Negative results depend on the absence of obvious nerve-root compression. Ineffective treatment of other degenerative disc diseases correlated directly with instability and "conservative" treatment tactics. Conclusion: The methods of degenerative disease treatment should be chosen depending on the presence of instability.

**Key words:** spinal segmental instability, degenerative disc disease (DDD), spine stabilization

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## INTRODUCTION

The majority of population suffer from disturbances because of lumbar disc changes. Low back pain accounts for 15% of all sick leaves and is the most common cause of disability for persons under 45 years of age. Estimates of lifetime prevalence range from 60 to 90% and the annual incidence is 5% of all population. 60% of working people have got disc diseases (1). The problem of diagnostics and treatment of intervertebral disc herniation, spinal stenosis, spondylosis or spondylolisthesis is significant for family doctors, neurologists, orthopedists and specialists of rehabilitation and gerontology centers. The most severe cases are treated by neurosurgeons. The failure rate for lumbar discectomy to provide a satisfactory long-term pain relief is below 25%, reoperations are performed in 18% of cases (2). Half of the patients having sick leaves up to 6 months

don't return to work at all (1), only 53% of sciatica cases eventually recover. A frequent reason for failed back surgery syndrome is spinal segmental instability. It is not considered as a separate disease, but the number of patients treated from low back pain caused by this reason keep increasing.

The aim of the work was to evaluate the instability influence on DDD and to determine early symptoms of microinstability and prognostic criteria for effective treatment.

## MATERIALS AND METHODS

483 patients with lumbar DDD treated in the Department of Neurosurgery of Vilnius University Emergency Hospital during 1999–2000 were analyzed. The patients were followed-up for two years and the results are summarized here. The narrowing of intervertebral space (Fig. 1), listhesis (up to 5 mm) (Fig. 2) and symptoms of degeneration in X-ray, myelograms, CT and MRI findings were estimated. Double vertebral body outline was estimated separately (Fig. 3). This sign is ignored by radiolo-

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gists as a result of incorrect CT scanning or considered as a symptom of massive disc herniation. We tried to show its significance in the diagnostics of instability, because we suspected that endplate scanning non-parallel to vertebral body could expose microlisthesis. Vertical instability in X-ray findings was divided into four types: I – angular narrowing, II – spondylosis, III – distinctive spondylosis with partial intervertebral space narrowing, IV – collapse (intervertebral space narrowing more than half disc height with endplate sclerosis) (Fig. 1).

Patients with instability were selected according to the significance of segmental instability in DDD pathogenesis. This group included patients with changes of intervertebral disc geometry, distinct degeneration and ineffectively treated patients with the absence of obvious nerve root compression. It was compared with control group of 40 cases with macroinstability, using the method of binary logistic regressive analysis. Probability of symptoms was evaluated by odds ratio (OR) in 95% confidence intervals for mean (95% CI). The similarity of symptoms between the two groups was statistically highly significant ( $p = 0.01$ ). The specificity of symptoms was 87% and sensitivity 76.6%. The prognostic criteria of microinstability were established according to these symptoms. Furthermore, the prevalence of instability among different DDD patients and its influence on the efficiency of treatment were evaluated.



Fig. 1. Signs of vertical instability in X-ray



Fig. 2. Horizontal instability (microlisthesis in L4-5 level)

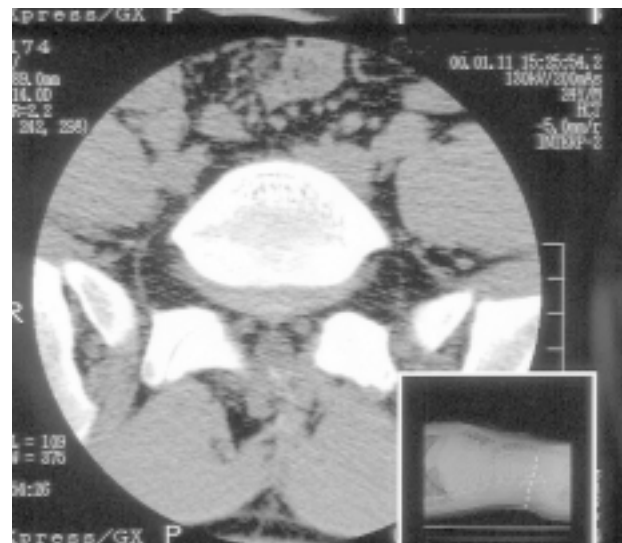


Fig. 3. Double vertebral body outline symptom in CT findings

## RESULTS

Clinical pathognomical instability signs were not found. The only negative straight leg symptom is characteristic for instability (OR 2.1; 95% CI 1.7–3.2,  $p = 0.001$ ). Sciatica in both legs predominated in control group (OR 2.7; 95% CI 1.2–6.1;  $p = 0.014$ ). In the group of instability the statistical significance of this symptom was limited.

The clinical symptoms of the group with macroinstability and its statistical significance are shown in Table 1. The high specificity of signs (98.51%) shows a great diagnostic value; 39.4% sensitivity shows that part of the patients are not included into this group due to high specificity. So the group of instability should be enlarged. The symptoms of instability group are shown in Table 2. Only signs of microinstability are left there. Instability could be prognosticated in 88.2% of cases according to these symptoms.

**Table 1. Symptoms characteristic of macroinstability group**

Symptoms	OR	95% CI	p
Double vertebral body outline in CT	15.6	5.2–46.7	0.001
Horizontal instability in X-ray	5.6	1.8–17.7	0.003
Obvious nerve-root compression	0.24	0.1–0.7	0.014

O. R. – odds ratio.  
CI – confidence Intervals for mean.

**Table 2. Symptoms of the group with suspected instability**

Symptoms	OR	95% CI	p
Double vertebral body outline in CT	41.3	9.4–182.2	<0.001
Microlisthesis (up to 5mm) in X-ray	8.8	5.1–15.2	<0.001
Obvious nerve-root compression	0.15	0.1–0.3	<0.001
Spondylosis (vertical instability, types 1–3)	1.6	1.1–2.4	0.01
Disc collapse (vertical instability, type 4)	3.5	2–6.1	<0.001

Figure 4 shows a direct dependence of treatment efficiency upon instability (OR 0.34; 95% CI 0.23–0.5;  $p < 0.001$ ): increase of treatment efficiency is inversely proportional to instability. The efficiency of treatment in cases without instability is prolonged (Fig. 5).

The instability prevalence among different DDD was analyzed. It was found in 36% of disc herniation cases, 63% of spondylosis, 65% of spinal stenosis and 100% of listhesis. Treatment efficiency dependence on disease is shown in Fig. 6 (OR 0.21; 95% CI 0.14–0.32;  $p < 0.001$ ). Only disc herniation treatment was effective. In the case of listhesis it reached only 38% (spinal fixation was performed in



Fig. 4. Dependence of treatment efficiency upon instability (n = 483)

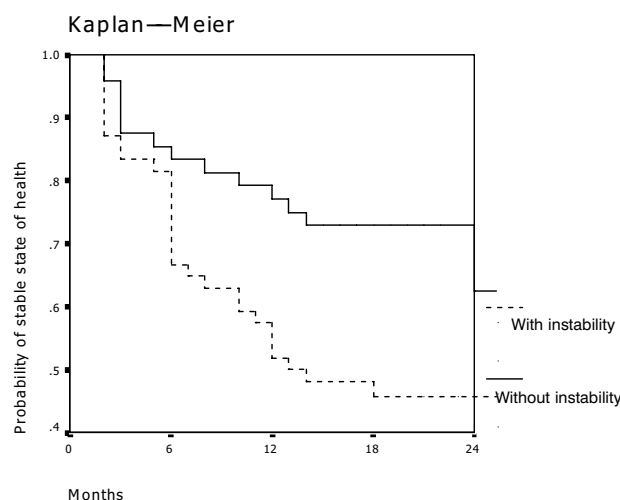


Fig. 5. Dependence of treatment efficiency prolongation upon instability

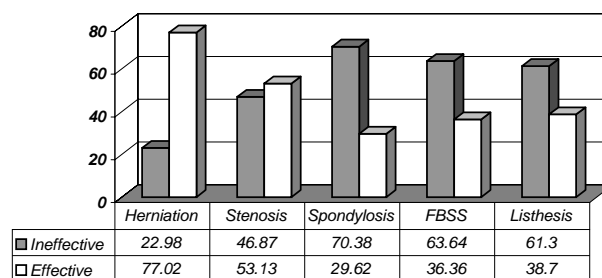


Fig. 6. Treatment efficiency of different degenerative diseases (n = 483)

3% of cases). This ratio confirms the significance of instability once more. We analyzed the treatment efficiency in different types of spinal stenosis. Ineffective treatment was found to correlate with instability in different types of spinal stenosis (Fig. 7). It is possible to conclude that ineffective stenosis treatment was determined by instability.

Results in cases of intervertebral disc herniation and spondylosis (osteochondrosis) also depended on

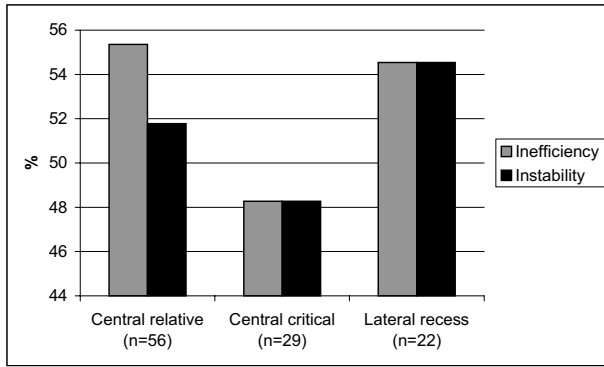


Fig. 7. Relation between instability and inefficiency of stenosis treatment (n = 107)

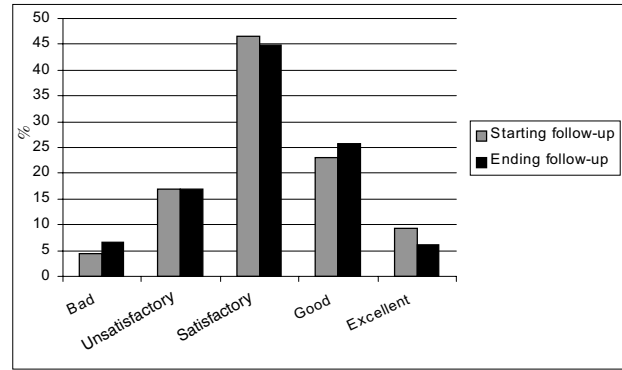


Fig. 9. Data on patients' state of health during follow-up period (n = 183)

the method of treatment (Fig. 8). In the group of ineffectively treated patients predominated “conservatively” treated patients or surgically treated without symptoms of nerve-root compression.

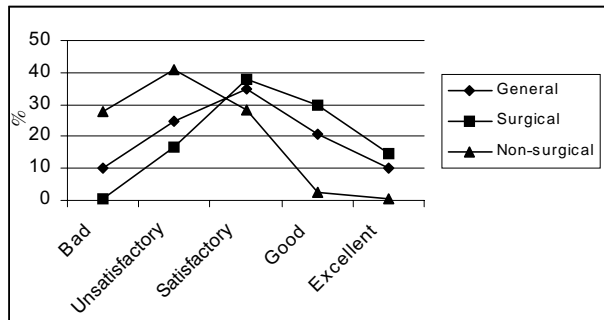


Fig. 8. Treatment efficiency relation between surgically and non-surgically treated patients (n = 483)

In 34% of DDD cases no considerable effect of treatment was obtained. In the group of surgically treated patients it amounted to 17% and in non-operated patients 68% (p < 0.001). Non-surgically treated patients suffered for a long time and under-

went all methods of “conservative” treatment. The two year follow-up data showed no changes in their state of health (Pearson’s correlation coefficient 0.6; p < 0.05) (Fig. 9). We think that improvement could be achieved using surgery (spinal fixation operations). An adequate method of fixation should be chosen depending on instability grade. The choice of methods is shown in Table 3.

**DISCUSSION**

The results confirm significance of instability in DDD pathogenesis and treatment. This problem is discussed more actively only in the recent literature (3). Instability signs are widely spread among different degenerative spine diseases, their frequency corresponds to data of other authors (4). The problem is a difficult diagnostics of instability (5–7). Often instability signs are not found while examining patients by ordinary methods. The necessity of dynamic methods of examination and various loading tests becomes more actual. They are under investigation in many countries (8, 9). Until these methods are not widely spread in practice, microin-

Table 3. Suggested treatment according to instability grade

Grade	Sign	Method of treatment
I	Spondylosis, inconsiderable intervertebral space narrowing	Prophylactic appliances, “conservative” treatment, possibility of intervertebral fusion if discectomy performed
II	Collapse	“Conservative” treatment, intervertebral fusion with/without fixation, intervertebral fusion if discectomy performed
III	Microlisthesis, microlisthesis with inconsiderable intervertebral space narrowing	“Conservative” treatment, fixation with possibility of intervertebral fusion, especially in case of discectomy
IV	Microlisthesis with collapse	Fixation with intervertebral fusion
V	Macrolisthesis Stenosis	Fixation, fixation with intervertebral fusion Decompression and fixation

stability signs determined in our work will enable physicians an earlier diagnosis of this pathology. It is easy to reveal and evaluate these signs by standard methods (4, 7, 10). The significance of straight leg symptom in disc herniation treatment is often mentioned in reports (11, 12). The results of our work also confirm it.

It is possible to create prophylactic appliances for spine stabilization, especially in early stages of DDD, to admit patients to hospital in time and to select patients for surgery properly. Correct selection is very significant in the cases of disc herniation. The importance of obvious nerve-root compression symptoms is proved in this work as well as in reports of other authors (13, 14). Different spinal fixation methods should be used for instability treatment. Most of the authors accentuate its advantage (10, 15–19).

## CONCLUSIONS

Segmental instability has no characteristic clinical symptoms and is difficult to diagnose using ordinary investigation methods. It is the main factor of ineffective DDD treatment. The main diagnostic signs of microinstability are: spondylosis, disc degeneration and collapse (vertical instability), microolisthesis, double vertebral body outline in CT (horizontal instability); negative straight leg symptom and the absence of obvious nerve-root compression. Instability should be treated surgically using spine fixation.

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**NESTABILUMO ĮTAKA DEGENERACINIŲ  
TARPSLANKSTELINIO DISKO LIGŲ GYDYMO  
TAKTIKAI IR REZULTATAMS**

**S a n t r a u k a**

Straipsnyje įvertinta nestabilumo įtaka stuburo degeneracinių ligų gydymo rezultatams, nustatyti nestabilumo prognostiniai kriterijai ir pasiūlytas gydymo metodas. Pagal sudarytus atrankos kriterijus ištirti 483 ligoniai. Net 47% jų įtartas segmentinis nestabilumas. Šios ir kontrolinės, makronestabilumą turinčių ligonių grupės, požymiai statistiškai patikimai sutapo. Nustatyti šie pagrindiniai mikronestabilumo požymiai: spondiliozė, vertikalus nestabilumas (tarpslankstelinio tarpo susiaurėjimas), horizontalus nestabi-

lumas (mikrolistezė iki 5mm), slankstelio dvigubo kūno kontūro simptomai (kompiuterinė tomograma). Šie požymiai leido 88% tikslumu diagnozuoti nestabilumą, nesant nervinių struktūrų kompresijos. Nustatyta, kad nepriklausomai nuo ligos pobūdžio didžiausią įtaką gydymo rezultatams, turėjo nestabilumas ir chirurginė gydymo taktika. Tiriamųjų grupėje gydymas buvo neefektyvus 17% operuotų ir 67% neoperuotų ligonių. Geriausi rezultatai gauti gydant tarpslankstelinę disko išvaržą. Tam įtakos turėjo neryškūs nestabilumo požymiai ir daugeliui ligonių taikytas chirurginis gydymas. Nepatenkinami gydymo rezultatai nustatyti pacientams, kuriems nebuvo įrodyta nervinių struktūrų kompresija. Kitų degeneracinių ligų gydymas neefektyvus, jei pasirenkama konservatyvi gydymo taktika ir neatsižvelgiama į mikronestabilumą.

**Raktažodžiai:** segmentinis nestabilumas, degeneracinė tarpslankstelinė disko liga, stuburo stabilizacija