

CASE REPORT

Operative treatment of degenerative spinal disease with concomitant Parkinson's disease – cases report

Leczenie operacyjne choroby zwyrodnieniowej kręgosłupa ze współwystępującą chorobą Parkinsona – opis przypadków

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Abstract

Introduction. Degenerative spine disease (DSD) with spinal stenosis disturbs sagittal profile of the spine, by reducing lumbar lordosis which may alter normal gait leading to neurogenic claudication. On the other hand, Parkinson's disease (PD), a progressive neurodegenerative process also largely alters spinal sagittal balance and influences physiological gait. A coexistence of these two morbidities raises a particular challenge for the spine surgeon.

Aim. The aim of the study is to present the results of surgical treatment of patients with lumbar spinal stenosis with concomitant Parkinson's disease.

Material and methods. We analysed the course of treatment of 7 patients with DSD and symptomatic lumbar spinal stenosis with concomitant PD. The course of surgery was analysed, presence of all complications was noted. Clinical evaluation based on assessing pain intensity levels and pain-free walking distance prior and after surgical treatment. Besides that, radiographic evaluation was performed and consisted of lumbo-sacral sagittal balance parameters (lordosis angle between L1 and L5 (LL), thoraco-lumbar junction angle measured between Th11 and L2 (TL), pelvic incidence (PI), sacral slope (SS), pelvic tilt (PT).

Results. Mean age at surgery was 65.4 years (56-74), the duration of PD prior to surgery was 5 years (1-11). Only in two patients one surgery was sufficient to decrease the symptoms. The remaining 5 patients required revision surgery in all, but one cases due to instrumentation failure. A total of 13 revision surgeries were performed. Primary surgical treatment in all cases consisted of decompression of neural structures with instrumented fusion in 6 cases, and without instrumentation in one case. The level of back pain according to VAS before surgery averaged 5.3 and decreased during the last follow-up to 2.6. The severity of leg pain before surgery averaged 3.6 and decreased to 2.1 during last follow-up. Preoperatively all patients presented a mismatch between LL and PI, which increased after surgery due to a postoperative LL reduction.

Conclusions. Surgical treatment of lumbar stenosis in patients with Parkinson's disease is burdened with a significant risk of complications. The most common cause of reoperation in these patients is destabilization of instrumentation and progression of sagittal balance malalignment.

Key words: Parkinson's disease, degenerative spine disease, spine, surgery, stenosis

Streszczenie

Wstęp. Choroba zwyrodnieniowa kręgosłupa (ChZK) z towarzyszącą stenozą kanału kręgowego poprzez zmniejszenie lordozy lędźwiowej zaburza profil strzałkowy kręgosłupa. Prowadzi to wtórnie do objawów klinicznych w postaci bólu krzyża oraz chromania neurogennego. Z drugiej strony choroba Parkinsona (ChP), postępujące schorzenie neurodegeneracyjne, także prowadzi do znacznego zaburzenia balansu strzałkowego kręgosłupa i upośledza prawidłowy chód. Współwystępowanie tych schorzeń stanowi zatem duże wyzwanie dla chirurga kręgosłupa.

Cel. Celem pracy jest ocena wyników leczenia operacyjnego chorych ze stenozą kanału kręgowego oraz współwystępującą chorobą Parkinsona.

Materiał i metody. Oceniono przebieg leczenia 7 chorych z ChZK i ChP, z objawami chromania neurogennego. Oceniano przebieg leczenia operacyjnego, obecność powikłań. W ocenie klinicznej brano pod uwagę nasilenie dolegliwości bólowych pleców i kończyn dolnych z użyciem skali VAS. Ponadto mierzono dystans chodu, który badani mogli przejść bez bólu, przed i po leczeniu operacyjnym. Wykonano też pomiary radiologiczne profilu strzałkowego kręgosłupa lędźwiowego: lordoza lędźwiowa (L1-L5), kąt przejścia piersiowo-lędźwiowego (Th11-L2), incydencję miednicy (*pelvic incidence=PI*), pochylenie kości krzyżowej (*sacral slope=SS*) i pochylenie miednicy (*pelvic tilt=PT*).

Wyniki. Wiek w chwili operacji wynosił średnio 65,4 lata (56-74), okres trwania ChP przed pierwszą operacją średnio 5 lat (1-11). Jedynie u dwóch chorych pierwotna operacja przyniosła ustąpienie objawów. Pozostałych 5 chorych wymagało powtórnego leczenia operacyjnego, głównie z powodu powikłań związanych z implantem. Łącznie wykonano 13 operacji rewizyjnych. Pierwotna operacja polegała na obarczeniu struktur nerwowych z usztywnieniem w 6 przypadkach, w jednym bez użycia implantów. Natężeniu bólu pleców przed operacją wynosiło średnio 5,3, obniżyło się do 2,6 podczas badania kontrolnego. Poziom ból kończyn dolnych zmniejszył się ze średnio 3,6 na 2,1. Przed operacją stwierdzono niestosunek pomiaru LL do PI, który nasilił się po leczeniu operacyjnym, głównie za sprawą zmniejszenia lordozy lędźwiowej.

Wnioski. Leczenie operacyjne ChZK u chorych z ChP obarczone jest znacznym ryzykiem powikłań. Najczęstszą przyczyną powtórnych operacji jest destabilizacja instrumentarium bądź dalsze zaburzenie dysbalansu strzałkowego kręgosłupa.

Słowa kluczowe: choroba Parkinsona, choroba zwyrodnieniowa kręgosłupa, leczenie operacyjne, stenoza

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Introduction

Degenerative spine disease (DSD) in different forms can be observed even in almost all population over 70 years of age. In the course of the disease hypertrophy of the intervertebral joints, ligamentum flavum and other elements lead to narrowing of spinal canal and intervertebral foramina resulting in clinical symptoms - neurogenic claudication [1]. As the disease progresses we observe radiologic changes, that is reduction of lumbar lordosis (LL), pelvic retroversion with decreased sacral slope (SS), increased pelvic tilt (PT). In this way patients compensate critical stenosis. Gait disturbances, similar to those as in DSD with lumbar stenosis may also accompany Parkinson's disease (PD). This slowly progressive neurodegenerative process of complex genetic aetiology, occurs in about 0.5% of population [2]. Typical features connected with motor function are: stiffness during walking, narrow base of support, short steps, leaned forward posture with diminished or absent lumbar lordosis and thoracic hyperkyphosis (camptocormia), bradykinesia, difficulties in starting movement, tremor [3-5]. Camptocormia, first described by Souques in 1914, also called "bent spine syndrome" and is observed during standing or sitting [6-8]. Camptocormia manifestation correlates with duration and severity of PD [8]. Simultaneous occurrence of DSD and PD in the elderly population causes reciprocal enhancing and disproportionate progression of clinical symptoms. Osteoporosis is a frequent additional problem, probably connected with the course of primary disease, age and periods of prolonged steroid intake [9,10]. Osteoporosis may accompany both PD and DSD [11,12]. Coincidence of DSD and PD, particularly with osteoporosis is a special challenge for spine surgeon [13-17].

Aim

The goal of this study is to present the results of operative treatment of patients with degenerative spinal disease with spinal stenosis and coexisting Parkinson's disease.

Materials and methods

This was a retrospective study based on the charts of patients operated in a single spine unit. Between 2007 and 2013, 10 patients (4 men and 6 women) were treated surgically with the diagnosis of DSD with coexisting PD.

Following inclusion criteria of inclusion were applied:

- diagnosis of PD before first spine surgery;
- presence of typical clinical symptoms of DSD, especially neurogenic claudication;

- confirmation of DSD diagnosis with use of imaging techniques, presence of spinal canal stenosis in magnetic resonance imaging (MRI) studies;
- minimal follow up period of 1 year;
- full medical records.

Due to shorter than 1 year follow up period in 2 cases and incomplete medical records in one case, finally we analysed 7 patients (5 women and 2 men).

Pain intensity using VAS was evaluated, in regards of both back and legs. Pain free walking distance was also measured pre- and postoperatively [18]. Following indicators of lumbosacral sagittal balance were assessed in lateral x-rays: lordosis angle between L1 and L5 (LL), thoraco-lumbar junction angle measured between Th11 and L2 (TL), pelvic incidence (PI), sacral slope (SS), pelvic tilt (PT) (Fig. 1).

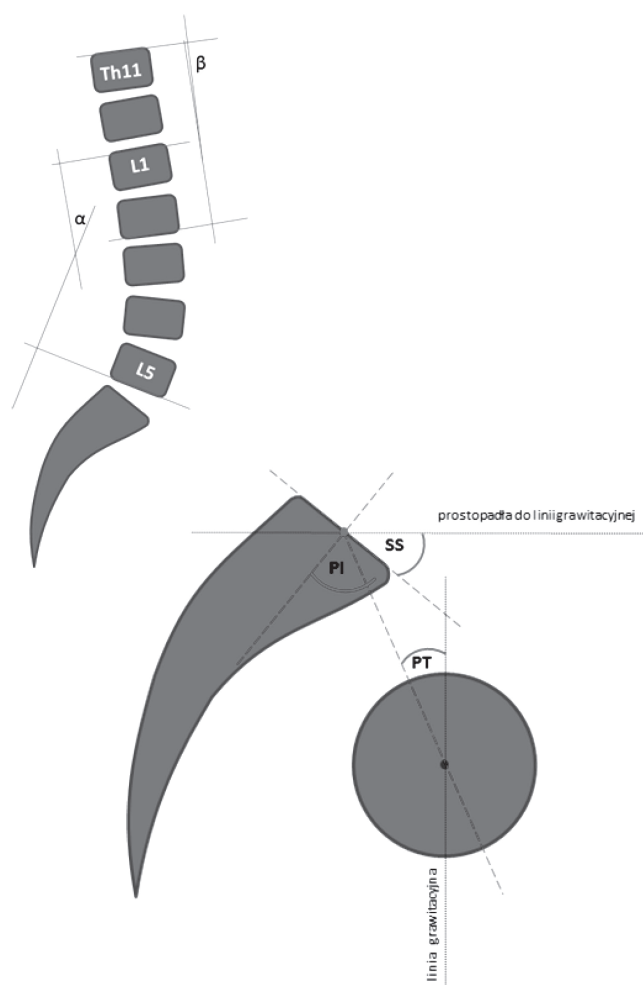


Fig. 1. Scheme of the measurements of the lumbo-sacral sagittal spine parameters.

Results

Age at surgery was on average 65.4 years (56-74), and duration of PD was 5 years on average (1-11). All 7 patients were treated surgically due to symptoms of degenerative

Table 1. Primary surgery, complications and revision surgeries in patients that had postoperative complications

patient	Primary surgery	complication	1 reop.	complication	2 reop.	complication	3 reop.	complication	4 reop.	complication	5 reop.
3	L4-S1 laminectomy with transpedicular stabilization	Rod breakage at the level of L4-L5	Rod exchange, at level L4-L5	Rod breakage at the level of L4/L5 and L4/L5 spondylolisthesis progression	L4/L5 Intervertebral fusion, L2-S1 fusion extension	Infection in the surgical site	Revision and wound debridement	L1 vertebra osteoporotic fracture, kyphotic deformity above fusion	Posterior fusion extension to Th11-S1	Implant destabilization at the level of Th11, Th12	Fusion extension to Th9-S1
4	L4-S1 laminectomy with transpedicular stabilization	Foraminal stenosis: L4/L5, L5/S1	Bilateral foraminectomy: L4/L5/S1	Instability of adjacent segment: L3/L4	Fusion extension and L2-S1 laminectomy						
5	L3-S1 laminectomy with transpedicular stabilization	Infection in the surgical site	Revision and wound cleaning	L2/L3 foraminal stenosis, instability of adjacent segment	Fusion extension to L2-S1						
6	L2-L5 laminotomy	Multisegmental instability: L2-S1	Posterior fusion L1-S1	CSF leakage, delay of wound healing	Revision and wound cleaning	Infection in the surgical site	Revision and wound debridement				
7	L4-S1 laminectomy with transpedicular stabilization	Instability one segment above fusion	Extension of fusion to level: L3-S1								



spine disease, that is back pain with neurogenic claudication. MRI studies revealed central spinal canal stenosis in all cases, moderate – in 2, severe – in 4 and extreme in one case acc. to Schizas [19]. Moreover, according to criteria described by Lee et al., foraminal stenosis was noted in all cases, including 5 patients with bilateral stenosis at one or more levels, 2 patients with unilateral multisegmental; with degenerative changes in facet joints and hypertrophy of ligamentum flavum [20]. Operative treatment consisted of nerve structures decompression from posterior approach in all cases. Stabilisation with transpedicular screws was performed in 6 cases, including one patient with additional interbody fusion with cage. In one case a laminotomy with no instrumentation was performed.

Two patients after spinal canal decompression with posterior L2-S1 stabilization gained permanent clinical status improvement, without complications during follow-up. Remaining 5 patients required revision surgeries. In total, 13 revision surgeries were performed (average 2.6 reoperation per patient, from 1 to 5). Complications and the method of its termination are presented in table 1. To sum up, 20 operative procedures were performed in 7 patients. Follow-up period was 32 months (from 12 to 60 months).

Average preoperative back pain level measured using VAS was 5.3 (4-7, median 5), and leg pain intensity was 3.6 on average (0-8, median 4). During first control examination average pain intensity was 2.9 (0-7, median 4) for back pain and 2.2 (0-6, median 1.5) for leg pain. At final follow up, average pain was 2.6 (0-5, median 3) and 2.1 (0-4, median 2.5) respectively.

Average pain-free walking distance before surgery was 392m (49-2000, median 99), at the first examination after surgery it lengthened up to 466m (50 -2000, median 200). After follow-up period average walking distance decreased to 248m (19-900, median 100).

In radiologic assessment, lumbar lordosis decreased by mean 8.7° (-27- +15) after initial surgery and remained stable during follow-up. The radiologic results are presented in table 2.

Table 2. Radiologic results in the study group. SS=sacral slop, PT=pelvic tilt

Patient	Before surgery				After initial surgery				Follow up			
	L1-L5 angle	Th11-L2 angle	SS	PT	L1-L5 angle	Th11-L2 angle	SS	PT	L1-L5 angle	Th11-L2 angle	SS	PT
1	36	2	37	18	35	-8	35,4	19,6	31	-9	34	21
2	48	-14	39	13	46	-15	43	9	43	-17	41	10
3	61	-2	55	9	-7	57	50	14	34	26	35	29
4	9	-4	23	21	25	4	23	21	24	-4	24	20
5	54	0	40	25	39	12	40	25	31	15	27,1	37,9
6	29	2	30,7	19,4	35	11	28	22,1	32	-5	33	25
7	39	3	41	28	32	-10	44	24	20	-18	40	32
average	39,4	-1,9	38,0	19,1	29,3	7,3	37,6	19,2	30,7	-1,7	33,4	25,0
min	9,0	-14,0	23,0	9,0	-7,0	-15,0	23,0	9,0	20,0	-18,0	24,0	10,0
max	61,0	3,0	55,0	28,0	46,0	57,0	50,0	25,0	43,0	26,0	41,0	37,9
median	39,0	0,0	39,0	19,4	35,0	4,0	40,0	21,0	31,0	-5,0	34,0	25,0

Changes of thoraco-lumbar junction angle were minor but increased in cases of proximal junctional failure at the level of instrumentation. SS decreased by 4.5° (-20- +2,0), and PT increased by 5.9° (-1,0 - +20), both of these parameters changed simultaneously, as a response to change of LL. In evaluated patients PI remained stable, and equalled 57° (44-69°, median 56°), on average. In all cases pre- and postoperatively we observed a mismatch between PI and LL. At final follow-up the difference was even greater than preoperatively.

Discussion

Operative treatment of severe forms of DSD with spinal stenosis is a standard procedure in aging spine surgery; results are satisfying in more than 80%, and serious complications occur infrequently [21-23]. Usually the extent of surgery can be limited up to one-two segments with most severe stenosis. Treatment of DSD in the course of PD is difficult and burdens high risk of complications – even up to 83% [13-16,24]. Many factors like poor bone quality (osteoporosis), sagittal balance impairment typical for PD, higher tendency to falls predispose to this fact [25]. In presented cases, we also noted very high ratio of complications, requiring multiple revision surgeries. It is worth emphasizing, that in 5 cases we achieved decrease of leg and spine pain after primary surgery and it remained stable at the latest examination. Mean walking distance initially increased by 18.8%, however during follow up period it significantly decreased to 63% of primary value. The reasons of this phenomenon are quite complex, we should take into account also natural course of PD. Direct comparison of analysed walking distance with data from other research is difficult, because this parameter in patients with PD is usually presented in correlation with time: 2 and 5 minutes distance [26]. This parameter depends on many factors, and it is not unequivocally connected with pain limitation, that was measured in this work. For example: significant and beneficial influence of rehabilitation on the degree of motor symptoms intensity was proved [27].

In our group, in most cases lordosis was significantly reduced after surgery, and thoraco-lumbar junction angle remained almost stable. The relation between LL and PI seems crucial for clinical result, according to Le Heuc both these parameters should be of similar value [28]. In our group only two, uncomplicated patients, did not have a decrease of LL, which matched the preoperative PI.

During primary surgery three segments were stabilized on average. Lack of fusion or too short fusion contributed to increasing of sagittal imbalance that manifested as: diminished lumbar lordosis and compensatory progression of PT angle and decreased SS angle. Post-operative increasing of sagittal imbalance, in combination with poor bone quality, may cause severe complications, failure of instrumentation, implant dislodgement etc [13-16,24]. Despite high risk of complications, operative treatment of DSD in patients with PD is indicated in the cases of severe spinal stenosis, causing radiculopathy or impairment of gait [17]. Restoration of sagittal balance and its maintaining is a prerequisite for successful surgical intervention in these patients (28,29). Sagittal imbalance, caused by DSD, is escalated by camptocormia phenomenon. One should remember, that changes in the course of PD are increasing over time. This additionally impedes the assessment of DSD surgery results. It seems that natural course of PD may be partially in charge of unfavourable results in analysed group [17]. Typically, in isolated DSD both extent of neural structures decompression and fusion should be as limited as possible [1,22]. On the other hand, in PD reduction of the extent of fusion faced with quickly increasing sagittal imbalance may lead in high rate of complications. In consequence, most authors suggest long fusion, from Th2 to S1, that is compatible with our observations [24,30].

Conclusion

Authors are aware of limited number of patients, that obstructs reliable statistical analysis of achieved results. Nevertheless, it can be stated, that operative treatment of lumbar degenerative spine disease in patients with Parkinson's disease is connected with high risk of complications. Limitation of fusion extent in this group may result in failure of instrumentation and the need of additional surgery. Multisegment spinal stabilization seems to be a solution of choice in the surgical treatment of degenerative spine disease in patients with Parkinson's disease.

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