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Neurosurgical Spine Implants in Geriatric Patients Treated Surgically for Lumbar Stenosis

Neurochirurgiczne implanty kręgosłupowe u chorych w wieku podeszłym leczonych operacyjnie z powodu stenozy lędźwiowej

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Abstract

Introduction. The incidence of degenerative lumbar spine stenosis increases with age. While young people tend to have simple disc herniations with root compression, older people develop degenerative stenosis: facet joint hypertrophy, osteophytes, and ligamentum flavum hypertrophy. A typical for senility is neurogenic claudication caused by lumbar foraminal stenosis. Its symptoms decrease in spine flexion.

Aim. The study consisted of a retrospective evaluation of medical data: analysis of the patient's age, description of the surgical procedure and a list of spine implants.

Material and Methods. The analysis included patients treated surgically for lumbar stenosis in 2020 in Neurosurgical Department of Collegium Medicum in Nicolaus Copernicus University (Bydgoszcz, Poland).

Results. The perioperative risk increases with the age of patients, therefore procedures in elderly patients should usually be less invasive, ephemeral, and even under local anesthesia. Therefore, neurosurgeons tend to insert spinal implants in senility to support the surgical effect and optimize the time of the procedure. Interspinous spacers are implants for neurogenic claudication. Interspinous spacers causes foraminal distraction and thus can theoretically induce nerve roots decompression in indirect mechanism, less invasive, with less tissue damage. We notice significantly more frequent use of interspinous spacers in patients over seventy.

Conclusions. This observation requires further research and analysis; however, it is consistent with the available literature and the actual state of clinical practice. This has potentially important implications for neurosurgical nursing — in geriatric patients after lumbar spine surgery, implants are significantly more common — interspinous spacers, which should be considered in nursing perioperative recommendations. **(JNNN 2021;10(3):91–95)**

Key Words: elderly patients, spine implants, spine surgery

Streszczenie

Wstęp. Częstość występowania stenozy zwyrodnieniowej kręgosłupa lędźwiowego wzrasta wraz z wiekiem. O ile u chorych młodszych kompresję struktur nerwowych wywołują przepukliny dyskowe, o tyle w wieku podeszłym przyczyną stenozy są zmiany zwyrodnieniowe: przerost stawów międzykręgowych, więzadeł żółtych i osteofity. Jednostką chorobową, typową dla osób w wieku podeszłym i spowodowaną stenozą kanału kręgowego i otworów międzykręgowych jest chromanie neurogenne, zaś objawy chromania ulegają remisji w pozycji zgięcia kręgosłupa, co jest jednym z ważnych objawów je różnicujących.

Cel. Badanie polegało na retrospektywnej ocenie danych medycznych: analizie wieku pacjenta, opisie zabiegu chirurgicznego oraz wykazie implantów kręgosłupa.

Materiał i metody. Analizą objęto pacjentów leczonych operacyjnie z powodu zwężenia odcinka lędźwiowego w 2020 r. w Klinice Neurochirurgii Collegium Medicum UMK (Bydgoszcz).
Wyniki. Ryzyko okołooperacyjne wzrasta wraz z wiekiem chorych, dlatego zabiegi w zakresie kręgosłupa w podeszłym wieku powinny być zwykle mniej inwazyjne, mniej obciążające, a nawet w miarę możliwości przeprowadzone w znieczuleniu miejscowym. Mając na względzie specyfikę chorych w wieku podeszłym, zakwalifikowanych do leczenia operacyjnego kręgosłupa lędźwiowego, neurochirurdzy mają tendencję do wszczepiania implantów aby wesprzeć efekt leczenia i skrócić czas zabiegu. Dystraktory międzykolcowe to implanty dedykowane dla chorych z chromaniem neurogennym. Powodują one potencjalną dystrakcję otworów międzykręgowych i tym samym mogą teoretycznie przyczyniać się do dekompresji zawartych w nich korzeni nerwowych w mechanizmie pośrednim, mniej inwazyjnym, z mniejszym uszkodzeniem tkankowym. Zauważamy istotnie częstsze stosowanie dystraktorów międzykolcowych u pacjentów po siedemdziesiątym roku życia.
Wnioski. Obserwacja ta wymaga dalszych badań i analiz, jednak naszym zdaniem jest zgodna z dostępną literaturą i stanem praktyki klinicznej. Fakt, że u chorych w wieku podeszłym po operacjach kręgosłupa występują częściej implanty ma potencjalnie istotne implikacje kliniczne z punktu widzenia pielęgniarstwa neurochirurgicznego i zaleceń pielęgniarskich. **(PNN 2021;10(3):91–95)**
Słowa kluczowe: pacjenci w podeszłym wieku, implanty kręgosłupowe, operacja kręgosłupa

Introduction

Lumbar surgery is among the most common procedure performed by neurosurgeons worldwide. Neurosurgical treatment refers to diseases with significant compression on nerve structures in the spinal canal or foramen, and conservative treatment is ineffective [1,2]. Compression is caused by disc herniation, degenerative process: ligamentum flavum and facet joints hypertrophy. Stenosis and nerve roots compression cause venous stasis in the internal vertebral plexuses and the lack of cerebrospinal fluid (CSF) on stenotic level, which exacerbates the adverse neurological symptoms and additionally orders surgery [3]. There are different types of lumbar stenosis with varying degrees of severity and location [4]. It is diagnosed by magnetic resonance imaging (MRI). Based on MRI, there are four grades of stenosis severity:

— grade 0: no lumbar stenosis without obliteration of the anterior CSF space [4],
— grade 1: mild stenosis with separation of all cauda equina [4],
— grade 2: moderate stenosis with some cauda equina aggregated making it impossible to visually separate [4],
— grade 3: severe stenosis with none of the cauda equina [4].

The primary goal of lumbar stenosis neurosurgical treatment is decompression. It is necessary to release the compressed nerve roots to reduce neurological symptoms. The technique, depending on the etiological factor, consists of disc material removal in case of simple herniation, but also removal of ligaments, osteophytes or drilling of overgrown bone structures. Decompression can theoretically increase the operated level spine relative instability [5]. Much of the lumbar spine surgery allows for the elective use of implants. When operating degenerative spine disease, neurosurgeon can perform a simple decompression or sometimes additionally use implants: transpedicular screws, interbody cages or interspinous spacers (ISS). There is no clear evidence that the use of these implants unequivocally improves the outcome. Therefore, their use is at the discretion of the neurosurgeon. Some of them avoid implants and promote "natural" surgical techniques without foreign bodies [5]. Some neurosurgeons in turn prefer to use implants and instrumentation [5]. In our department, we use a centered model of surgical techniques, but we tend towards non — implant procedures, as long as it is possible to perform a simple decompression.

The study consisted of a retrospective evaluation of medical data: analysis of the patient's age, description of the surgical procedure and a list of spine implants.

Material and Methods

The analysis included patients treated surgically for lumbar stenosis in 2020 in Neurosurgical Department of Collegium Medicum in Nicolaus Copernicus University (Bydgoszcz, Poland). In lumbar stenosis surgical procedures using spinal implants is potentially elective in particular cases. Patients operated due to cervical discopathy, lumbar spondylolisthesis, spinal cord stimulation and injuries were not taken into account, as the use of implants is obligatory in this group. The analyzed group consisted of patients with lumbar degenerative stenosis or degenerative spondylolisthesis: in these patients, the strategy of surgical treatment is decompression, and fusion or using interspinous distraction is elective (additional) surgical option. According to many authors, there are no significant differences in the results of surgical treatment in the case of decompression vs decompression+instrumentation.

No bioethical commission approval was needed. There was no contact with the patient, nor even an analysis of medical records regarding their neurological status, symptoms and treatment course. The analysis was only statistical and comparative. In our study, patients with lumbar spine treated surgically were taken into account. ICD-10 codes of diagnoses used for analysis were: M47.2 and M51.1. Based on the ICD-10, the analyzed patients were divided into two groups. The statistical analysis was performed with the use of the statistical program STATISTICA 13.1 by StatSoft®. The age distribution of the analyzed patients met the criteria of a normal distribution, therefore, in the statistical analysis, the parametric Student's t-test was used to compare the age in two groups of patients (M47.2 vs M51.1). The significance level $p<0.05$ was considered statistically significant. In 2020, 52 patients with the diagnosis M47.2 and 295 with the diagnosis M51.1 were treated surgically in our department. The ICD-10 M47.2 group consisted of patients with degenerative stenosis, and M51.1 patients with disc herniation. The mean age of patients diagnosed with M47.2 was 64.87 years and those diagnosed with M51.1 48.76 years. Therefore, a total of 347 patients (197 women, 150 men) were operated on due to stenosis of the lumbar spine with the nerve roots compression. Two groups of surgical procedures were analyzed according to homogeneous groups of patients (pol. *jednorodne grupy pacjentów*, JGP). Among the analyzed JGPs, spine procedures without the use of implants — A22 constituted 153 procedures, while H52 (with an implant) 70, among them 56 procedures were 84.58: ISS implantation. In A22 group, the main IDC-9 procedure was 80.513, which is simple disc herniation removal. The ISS was the only elective spinal implant in the study group, which was quite an important additional conclusion. The anesthesiologic risk of the procedure was assessed on the basis of American Society of Anesthesiology scale (ASA) [6]. According to ASA the patients were classified, on the basis of preoperative assessment, into one of five groups (I–V) [6]:

- group I — patient with no burden of additional diseases (according to our hospital internal guidelines, no patient with lumbar spine disease is ASA I),
- group II — patient with moderate systemic disease: well — controlled arterial hypertension, controlled diabetes, chronic bronchitis,
- group III — a patient with a severe systemic disease that limits his capacity or activity,
- group IV — a patient with a very severe systemic disease, which is a threat to his life: renal failure, congestive heart failure (in clinical practice all patients ASA IV cannot be qualified to spine surgery),
- group V — a dying patient who is likely to die if not operated on, e.g., a patient with a ruptured aortic aneurysm (no patients with spine diseases for surgery are ASA V).

Results

On the basis of the Student's t-test, it was found that in the of M47.2 group, the mean age was significantly higher than in the M51.1 group (Table 1). ISS implants were used in patients in the older group of patients.

It was also found that in group M51.1, ASA was always II, while in group M47.2 ASA III was the most common (Table 2).

Table 1. Group of patients (M47.2 vs M51.1) with significant age difference

ICD-10	Mean age	ICD-9 (procedure)	ASA	Spine implant [interspinous]*
M47.2	64.87	84.58	II, III, IV	+
M51.1	48.76	80.513	II	–

* Percentage of surgeries with interspine spacer support

Table 2. Anesthesiological risk of lumbar spine procedure (ASA) in M47.2 group

ASA in M47.2 group*	ASA II	ASA III	ASA IV
%	30.36	64.29	5.36

* All patients M51.1 were ASA II

On the basis of Pearson's correlation, it was found that the use of ISS (procedure 84.58) significantly positively correlated with the ASA score, indicating an increased risk of anesthetic surgery.

Discussion

The literature on the use of ISS in elderly (geriatric) patients was reviewed. Three papers from 2004–2012 were found.

Lee et al. (2004) assessed postoperatively by MRI and the Swiss Spinal Stenosis Questionnaire. Cross-sectional areas of the dural sac and intervertebral foramina at the stenotic level were measured postoperatively and compared with the preoperative values [7]. He revealed that area of the dural sac increased 22.3% and intervertebral foramina increased 36.5% [7]. According to Lee, intervertebral angle and the posterior disc height changed significantly. Lee concluded that 70% percent of the patients were satisfied with the surgical outcome,

so ISS was proved as effective in elderly patients with lumbar stenosis [7].

Ryu et al. (2010) assessed the safety and efficacy of one level decompression with the ISS placement compared with one level simple decompression with no implants in elderly patients with degenerative lumbar spinal stenosis [8]. He conluded that decompresion with ISS is a safe and efficacious treatment for selective elderly patients with lumbar stenosis, particularly for relieving low back pain comparing to simple decompression [8]. According to Ryu, additional ISS placement did not alter the disc height or sagittal alignment at the mean 21 months follow-up interval [8].

Wan et al. (2012) evaluated the biomechanical effect of the X-Stop device on the intervertebral foramen and segmental spinal canal length, and the intervertebral disc space at the implanted and the adjacent segments in patients with lumbar spinal stenosis [9]. He concluded that X-Stop implantation efficiently enlarged foramina in the elderly patients with lumbar stenosis at the operated level with benefits for patients [9].

The collective results and conclusions on the literature review and the use of spinal implants (ISS) in geriatric patients are presented in Table 3.

Table 3. Literature data (2004–2012) about ISS in geriatric patients

Study	The benefits ISS use in geriatric patients, indicating their legitimacy in this group
Lee et al. (2004)	+
Ryu et al. (2010)	+
Wan et al. (2012)	+

Conclusions

Based on our own experience, analysis of procedures, and on the basis of literature review, it can be concluded that ISS are used in geriatric patients. First, because of the prevalence of neurogenic claudication in elderly patients, ISS increases the height of the intervertebral foramen and its implantation is beneficial. Secondly, due to the anesthesiological condition (ASA III), ISS allows to shorten the procedure and minimize its scope.

Implications for Nursing Practice

This has potentially important implications for neurosurgical nursing and the rehabilitation. Firstly, geriatric patients are more burdened, therefore fewer radical procedures with smaller skin incisions should be aimed at, and the hospital period should be kept to a minimum. Secondly, in geriatric patients after lumbar spine surgery, implants are significantly more common — interspinous spacers, which should be considered in nursing perioperative recommendations.

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