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DEGENERATION OF THE INTERVERTEBRAL DISC AS AN INTERDISCIPLINARY CLINICAL PROBLEM IN THE CONTEXT OF NEUROSURGERY: A SUMMARY OF THE STATE OF KNOWLEDGE. PART 2

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: The management of degenerative musculoskeletal disorders, including degeneration of the intervertebral disc (IVD) and its neurological consequences, is complex. This approach requires coordinated collaboration among specialists, especially neurosurgeons, nurses, and physiotherapists.

Aim of the study: This study aimed to perform a review of scientific reports and summarize the current state of knowledge regarding the degeneration of the IVD in the context of various treatment aspects, both in terms of conservative therapy and surgical treatment.

Material and methods: The literature review was based on searching key medical databases such as PubMed, MEDLINE, and Scopus. A search strategy was defined, including keywords, synonyms, and controlled vocabulary terms (MeSH terms). The search covered the last 20 years and focused on aspects of conservative and surgical treatment. Studies meeting the inclusion criteria underwent a full-text analysis. Data and information gathered from the literature analysis were synthesized to provide a comprehensive overview of the state of knowledge on the investigated issue.

Results: Classical conservative methods included neurorehabilitation, heat treatment, proper body positioning, and pain management. The common feature of all minimally invasive methods is percutaneous access, where instruments are introduced through small puncture incisions. The effectiveness of conservative treatment for patients with degenerative lumbar spine disease fluctuates around 40%. Meanwhile, the surgical treatment of lumbago remains a controversial topic, with many unknowns, lacking clear algorithms and standards. Further research and the development of clinical practice guidelines are crucial for improving diagnostic, therapeutic, and preventive methods related to this exceptionally complex clinical problem.

Conclusions: The process of treating IVD degeneration is complex and should be considered individually in each case. Collaboration between a neurosurgeon and a physiotherapist forms a dynamic team that addresses both diagnostic and therapeutic aspects. This synergy allows for close monitoring of the patient, combining

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surgical and rehabilitation aspects, resulting in comprehensive care and maximizing treatment outcomes, thereby improving the quality of life (QOL).

KEYWORDS: intervertebral disc degeneration, low back pain, management, conservative treatment, neurosurgery, state of knowledge

Background

Intervertebral disc (IVD) degeneration, resulting from various genetic and environmental factors, is a significant musculoskeletal disorder [1,2]. It is characterized by the gradual deterioration of the structure and weakening of the function of the IVD, leading to diverse clinical symptoms that significantly impact the quality of life (QOL) of patients [3]. Therefore, understanding the etiopathogenesis, diversity of symptoms, and effective management of IDD requires an interdisciplinary approach, combining the knowledge and expertise of specialists in orthopedics, neurology, physiotherapy, and even psychology [4].

Aim of the study

This study aimed to delve deeper into issues related to IVD degeneration, focusing on various aspects of treatment, both in the context of conservative therapy and surgical intervention. Through a holistic approach to this problem, we seek to develop a comprehensive understanding of IVD degeneration as an interdisciplinary clinical issue, with the hope of better understanding this disorder and effectively tailoring therapeutic strategies to individual patient needs. An analysis of available scientific literature allows for summarizing the current state of knowledge regarding etiopathogenesis, clinical symptoms, and various aspects of the diagnosis and treatment of IVD degeneration. The effectiveness and risk of complications during conservative management are also compared with neurosurgical treatment.

Material and methods

Information sources

The exploration of well-known medical databases, such as PubMed, MEDLINE, and Scopus, played a crucial role in conducting a thorough literature review. Understanding the importance of a comprehensive and methodical process, a carefully crafted search strategy was developed to encompass the broad spectrum of available literature. This required the integration of various search components, including keywords, synonyms, and controlled vocabulary in the form of Medical Subject Headings (MeSH terms).

Search strategy

The careful formulation of the search strategy was instrumental in guaranteeing an exhaustive and contemporary examination of the literature. Covering the past two decades, the search was strategically tailored to capture the most recent advancements and understandings pertaining to conservative and surgical methods for IVD management. This temporal scope was selected to strike a balance between incorporating the latest developments and retaining an adequate historical context.

Eligibility criteria

Articles that satisfied the inclusion criteria underwent a comprehensive analysis of their full texts, assessing both the quality and quantity of collected data. This thorough examination included a meticulous review of the study design, participant characteristics, intervention methods, and outcome measures.

Data synthesis

The synthesis of data and information derived from the literature analysis yielded a comprehensive overview of the present state of knowledge concerning the researched subject. Throughout the literature review, adherence to standard ethical principles was maintained, ensuring that all data obtained from the studies were utilized in accordance with the principles of scientific integrity.

Reporting bias

An integral facet of the literature review process involved a meticulous consideration of potential reporting bias within the chosen studies. Recognizing the conceivable impact of selective reporting on the overall outcomes and interpretations, the authors performed a systematic examination to assess the presence of reporting bias across the included papers.

This scrutiny aimed to ensure a comprehensive and unbiased evaluation of the literature's findings and conclusions.

Results

The synthesis of the literature on conservative and surgical treatment options for IVD conditions revealed a nuanced landscape of research findings. The comprehensive review encompassed studies from the past two decades, shedding light on the conservative and surgical methods for the treatment of IVD. The narrative review included the following components: therapeutic management of discopathy with a rationale for choosing methods for treating discogenic low back pain (LBP); interventional treatment in discopathy, featuring methods such as chemonucleolysis, discectomy, arthroplasty, spondylodesis, and interspinous stabilization; as well as a comparison of the effectiveness of conservative treatment versus surgical treatment. The synthesis of data and information from the reviewed studies provided a robust foundation for understanding the current state of knowledge regarding conservative and surgical treatment approaches for IVD. The authors applied standard ethical principles throughout the literature review, emphasizing integrity and honesty in the utilization of data obtained from the selected studies.

Discussion

Treatment approaches in discopathy

The treatment of spinal pain syndromes includes conservative, surgical, and so-called minimally invasive approaches. Classical conservative methods encompass physical therapy, heat therapy, proper body positioning, and pain management [5–8]. A common feature of all minimally invasive methods is percutaneous access, where instruments are introduced through small puncture incisions [9].

Among the latter, transforaminal epidural steroid injection was included and performed under X-ray control. It is considered significantly more effective than the previously used epidural steroid injection. The procedure involves administering corticosteroids and anesthetic into the peri-radicular area under X-ray guidance, following radiculography. Strong evidence supports its effectiveness in cases of both anesthetic and corticosteroid administration for disc herniation, whereas moderate evidence supports the efficacy of anesthetic-only for disc herniation. Additionally, there is moderate evidence for the effectiveness of using both anesthetic and corticosteroids for spinal canal stenosis and limited evidence of effectiveness for LBP and postoperative spine pain [10].

It has been shown that implementing imaging diagnostics for spinal pain syndromes in the early phase, after excluding the alarm symptoms discussed above, does not improve treatment outcomes. Therefore, ordering imaging studies for patients with acute or subacute symptoms of spinal pain is not recommended, except for patients exhibiting alarming symptoms [11]. Attempts to categorize treatment methods for LBP were made by Handelman et al. [12], who divided 150 commonly used methods, both conservative and surgical, into 10 categories (Table 1).

Table 1. Selected methods for treating discogenic low back pain [12]

1.	**Pharmacotherapy:**
	NSAIDs: diclofenac, ibuprofen, ketoprofen, piroxicam, sulindac, nabumetone, meloxicam
	Antidepressants: amitriptyline, nortriptyline, clomipramine, imipramine, paroxetine, doxepin, sertraline, venlafaxine, duloxetine
	Muscle relaxants/anxiolytics: tizanidine, tolperisone, diazepam, baclofen; alprazolam, lorazepam, temazepam
2.	**Manual therapy:**
	Acupressure, reflexology, Swedish massage, shiatsu, effleurage
3.	**Physical exercises:**
	McKenzie method
	Proprioception exercises
	Stabilization exercises
4.	**Physical therapy:**
	Cryotherapy, heat treatment, cutaneous electrostimulation
	Iontophoresis, transcutaneous electrostimulation, Acu-Tens, electromagnetic stimulation, laser therapy
	Shockwave therapy (ESWT)
	Cryotherapy, heat treatment, cutaneous electrostimulation
5.	**Education:**
	Spine school, biofeedback, behavioral therapy
	Support groups, psychotherapy
6.	**Injections:**
	Epidural injections:
	With corticosteroids, interlaminar, with anesthetic
	Facet joint block
	Radiofrequency denervation: Danish method, ISIS technique
	Lumbar-sacral blocks
	Ischial bursa injections
	Transforaminal epidural steroid injection
7.	**Minimally Invasive and Intradiscal Methods:**
	Intradiscal electrotherapy (IDET)
	Aspiration percutaneous lumbar discectomy
	Laser nucleoplasty

Table 1 contd.

8.	**Surgical Methods:**
	Discectomy
	Postero-lateral fusion (PLF)
	Implantation of stimulator
	Laminectomy
	Interbody fusion: PLIF, TLIF
	Arthroplasty: Charite, roDisc, AcroFlex, progressive nucleus replacement
	Interspinous stabilization: XSTOP, Wallis, Estendure, CoFlex, DIAM
	Chemonucleolysis
	Dorsal column stimulator
	Brain stimulation: thalamus, internal capsule, PAG/PVG
	Facet joint plasty
	Morphine pump
	Rhizotomy
9.	**Prevention and Lifestyle Modification:**
	Weight loss, smoking cessation, regular physical activity
	Supportive devices: belts, mattresses, chairs, shoe inserts
10.	**Alternative Medicine:**
	Acupuncture: acupressure, moxibustion, French energetic, Korean
	Tai-Chi
	Herbal medicine
	Meditation
	Supplementation: vitamin B12, glucosamine
	Qi Gong
	Homeopathy

Surgical treatment in discogenic pain

Surgical treatment of spinal pain syndromes involves various operative methods. Simplifying a bit, these approaches can be divided into those used for radicular syndromes and those used for LBP syndromes. Frequently, these syndromes overlap, and the therapeutic methods applied influence the course of both types of complaints. There is a noticeable tendency to more often qualify patients with radicular symptoms for surgical treatment. Surgical treatment for this indication is not considered particularly controversial. Surgical treatment for sciatica is reserved for patients with a disease history lasting at least 10–12 weeks, except for patients with acute neurological symptoms such as cauda equina syndrome or muscle strength deficits. However, the treatment of pain resembling LBP is still a controversial topic, with many unknowns and a lack of clear algorithms and standards. Moreover, there is an increasing number of implants and surgical methods, adding further complexity to the matter [13].

Clinical symptoms in about 85% of patients with acute IVD herniation will resolve without surgical treatment within approximately 6 weeks and 70% within 4 weeks [14]. Most clinical practitioners recommend waiting for 5 to 8 weeks before considering surgical treatment, after excluding conditions requiring urgent intervention. These include cauda equina syndrome (sensory disturbance, sphincter dysfunction, and flaccid paralysis), progressive limb paralysis, acute limb paralysis, or sudden worsening of limb paralysis, as well as acute pain unresponsive to opioid treatment [15]. The last indication, however, is a matter of debate.

Operative methods include interlaminar approaches and intradiscal procedures. The former includes laminectomy with discectomy and microdiscectomy. The main advantage of microdiscectomy is that it provides a clear view of the surgical field and illumination using an operating microscope, as well as a smaller skin incision. However, treatment outcomes do not differ between the two methods [16]. Intradiscal procedures encompass chemonucleolysis, automated percutaneous lumbar discectomy using a nucleotome, percutaneous endoscopic discectomy, intradiscal endothermal therapy, and laser disc decompression [17].

Chemonucleolysis

This is a procedure involving intradiscal injection of chymopapain. In a prospective, randomized study involving 100 patients, it was demonstrated that chemonucleolysis is as effective as surgical discectomy, based on the intention-to-treat (ITT) analysis. The disc height loss over the study period was similar in both groups, with a lower complication rate in the chemonucleolysis-treated group. The authors of the publication suggest that reintroducing chemonucleolysis would be beneficial for patients. Possible complications include anaphylactic shock, which is minimized by skin tests before the procedure. Additionally, complications may include discitis, neurological deficit, vascular damage, thrombophlebitis, and, very rarely, transverse myelitis [18–21].

Discectomy

Automatic percutaneous lumbar discectomy using a nucleotome shows positive treatment results; however, there is still a scarcity of reliable, methodologically sound studies on its effectiveness within the literature [22]. In the case of laser disc decompression, the situation is similar – despite being used for many years, there is a lack of solid evidence for its ef-

fectiveness in the available literature [23]. Currently, there is a prospective, randomized study comparing the treatment outcomes of laser decompression with open discectomy [24]. Results of treating disc herniations using an endoscopic method indicate that it is a safe and effective approach. In a study involving 163 patients, it was shown that during the follow-up period, 70% of patients reported no complaints, 18% experienced sporadic pain, and 12% showed no improvement in symptoms after the procedure. Moreover, 8 patients required reoperation. Damage to the dura mater during the procedure occurred in 6 patients [25]. Despite numerous critical publications, discectomy remains the fundamental surgical treatment method for sciatica in the course of degenerative disc disease [26].

Arthroplasty

In the late 1990s, another surgical method was introduced – arthroplasty – involving the replacement of the degenerated IVD with a device that preserves mobility between adjacent vertebrae. The primary advantage of this method, as intended, is the unchanged biomechanics after removing the source of pain, which is the degenerated IVD. This ensures greater comfort for patients and does not pose a risk of adjacent-level disease. Aghayev et al. [27] performed a study involving 248 patients treated with this technique, demonstrating its effectiveness in achieving long-term pain relief, consequently reducing the use of analgesic medications, and improving QOL. The procedure itself proved to be safe, although the operator must be aware of potential complications. The treatment outcome remained stable during the five-year follow-up period. Most operated segments retained mobility during follow-up, although osteophytes appeared in about half of them.

The five-year results of a prospective, randomized, multicenter study conducted by the Food and Drug Administration (FDA) in the United States, investigating the treatment outcomes of patients with degenerative disc disease using the ProDisc L prosthesis (Synthes, USA) versus the outcomes of patients treated with fusion, confirmed that both methods are effective, with a superiority in efficacy of the ProDisc L arthroplasty. Patients in both groups maintained a significant clinical improvement over the five-year follow-up period. The arthroplasty group showed significantly better results measured on certain scales only. Although patients treated with the implant avoided segmental stiffness and had a better QOL than those treated with fusion, both methods are justified treatment options in the selected group of patients [28].

Spondylodesis

This is one of the more popular surgical methods for treating LBP. Initially, it was used in the treatment of spondylolisthesis and instability, defined as the pathological displacement of adjacent vertebrae in the sagittal plane, on functional X-ray imaging, by more than 6–8 mm [29]. Initially, the most popular were posterior-lateral fusions, without additional internal stabilization. Although the initial treatment results were very good, over time it turned out that the percentage of patients who did not achieve a bony fusion after spondylodesis was too high, reaching up to 56% in some studies [30]. To improve the conditions for bony fusion, additional stabilizing elements such as wiring of transverse or spinous processes or interlaminar hooks were introduced. However, it was transpedicular stabilization, first described by Roy-Camille and Steffee, that revolutionized posterior access spondylodesis [31]. This technique allows for the relatively easy creation of a durable stabilization structure involving all three columns of the spine, even after resection of a significant portion of the posterior bony structures. The main drawback of posterior-lateral spondylodesis is the unfavorable biomechanical properties resulting from bony fusion between the elements of the posterior column of the spine. Such a system does not create optimal conditions for adjacent vertebrae and leads to the overloading of internal stabilizers, such as pedicle screws, and subsequently their damage. Therefore, additional support for the anterior column of stabilized vertebrae in the form of interbody implants replacing the removed disc has been used over time. This procedure not only increases the rate of bony fusions but, above all, improves the functional treatment outcomes. The basic techniques of interbody stabilization include anterior lumbar interbody fusion (ALIF), posterior lumbar interbody fusion (PLIF), and transforaminal lumbar interbody fusion (TLIF) [32].

Below are several recommendations regarding the use of interbody stabilization according to the principles of Evidence-Based Medicine (EBM). With a recommendation level B: additional use of interbody stabilization is recommended as an option to improve the rate of bony fusion (which, in turn, reduces the rate of reoperations) in patients undergoing lumbar stabilization. However, the increased rate of bony fusion after the use of interbody stabilization did not translate into an improvement in clinical outcomes (many studies with a data reliability level of II). Additional use of posterior-lateral spondylodesis is not recommended in patients undergoing lumbar interbody stabilization, as the studies have proven the lack of significant clinical benefits and a higher rate of complications when using spondylodesis for interbody stabilization (studies with data reliability levels

of II and III). With a recommendation level of C: the use of frozen allografts for ALIF is associated with a lower rate of pseudoarthrosis compared to the use of lyophilized allografts for ALIF procedures in the treatment of degenerative disc disease with or without spondylolisthesis. However, the improvement in the rate of bony fusion did not translate into an improvement in clinical outcomes (one study with a data reliability level of II). ALIF is associated with better clinical outcomes and fewer perioperative complications than posterior-lateral spondylodesis with instrumentation, although the rate of bone fusion is similar in both techniques (two studies with data reliability levels of III) [33]. There is no clear evidence for better clinical and radiological outcomes depending on the interbody techniques used. General recommendations regarding the technique to be used for achieving interbody stabilization cannot be established.

The study by Yan et al. [34] demonstrated good results in the treatment of degenerative adult scoliosis using interbody stabilization, both with the PLIF and TLIF techniques. Videbaek et al. [35], in a randomized clinical trial, compared the treatment outcomes of two groups of patients with severe LBP, with a follow-up period of 10 years. One group was treated with a posterior-lateral instrumented fusion and ALIF, while the second group underwent posterior-lateral instrumented fusion alone. No differences in treatment outcomes were observed between the two groups.

Interspinous stabilization

Intervertebral stabilization (also known as intervertebral fusion) is a surgical technique aimed at restoring spinal stability through the use of special intervertebral implants. This procedure is often employed in the treatment of spinal disorders such as IVD degeneration, spinal deformities, or spinal injuries. Intervertebral stabilization aims to maintain the proper alignment of vertebrae, preventing excessive movement in the treated area. This helps reduce pain, improve spinal stability, and counteract further IVD degeneration.

The primary function of an interspinous stabilizer is to limit the hyperextension of adjacent vertebrae without affecting the range of motion in flexion, rotation, and lateral bending. This restriction reduces the folding effect and the intrusion of the ligamentum flavum into the spinal canal, causing stenosis. It is accepted that the first interspinous stabilizer was introduced by Knowles in the 1950s. The implant was made of stainless steel and had a cylindrical shape. A common problem observed in patients was the spontaneous migration of the device – it lacked anchoring mechanisms in the proper interspinous space. The device was discontinued due to treatment failures and an unclear mechanism of action. On the other hand, in 1997, Minns first described the experimental use of a flexible interspinous implant. The silicone implant had the shape of a dumbbell and was available in several sizes, with a central dimension of 8–15mm. The device aimed to prevent the approximation of adjacent spinous processes, reduce the load on facet joints, and decrease intradiscal pressures, especially during axial loading [36,37].

Richards et al. [38,39] compared the biomechanical parameters before and after the implantation of the X-STOP stabilizer in an in vitro study. They demonstrated that the implantation of the stabilizer leads to a significant increase in the surface area and dimensions of the spinal canal, as well as a significant increase in the surface area and the transverse dimension of the intervertebral foramina. These results were confirmed by an in vivo study conducted by Siddiqui et al. [40], in which patients who had undergone X-STOP stabilizer implantation were analyzed for the dimensions of the spinal canal and intervertebral foramina using a dynamic MRI. Similarly, Lee et al. [41], based on static MRI, described a significant enlargement of these parameters. Due to the observation that distraction of the intervertebral space mainly affects the posterior part of the annulus fibrosus with the adjacent posterior longitudinal ligament, considered by many authors as a cause of pain, an increasing number of implants of this type are used in discogenic LBP.

The X-STOP consists of a longitudinal core stabilized by lateral wings. It is introduced in the form of two independent elements that are folded together to secure the core symmetrically on both sides of the interspinous ligament. Its main indication for use is lumbar spinal canal stenosis, causing neurological claudication symptoms in patients whose symptoms decrease with spinal flexion or the sitting position [42]. Lindley et al. [43] examined post-mortem changes in kinematics after the implantation of the stabilizer at the L2–L5 levels. They demonstrated that the implant significantly affects the mobility of the instrumented levels during flexion and extension. The implantation itself has a minimal impact on the resting geometry of the spine, positioning adjacent segments in approximately 2 degrees of flexion. The greatest limitation occurs during the transition from flexion to maximum extension. They did not find a significant impact on mobility in other planes, i.e., lateral bending and rotation around the longitudinal axis of the spine. During implantation, there is no need to remove the supraspinous ligament. Importantly, the positioning and mobility of adjacent segments remain unchanged. It was approved by the FDA in 2005.

The Wallis stabilizer is made of polyetheretherketone (PEEK). It is attached to the spinous processes

with flexible straps, making it behave somewhat like a dynamic implant, adapting to one's anatomy during the flexion-extension cycle. It requires the removal of the supraspinous ligament during implantation. Clinical studies using this stabilizer are currently underway. The Coflex stabilizer originated in France under the name Interspinous U, reflecting its design. It consists of a titanium plate bent in the shape of the letter U. Wings on the lateral surface of the upper and lower planes serve to anchor the implant in the interspinous space. They are slightly displaced from each other to allow stabilization at several adjacent levels. The device is inserted into the space after compressing its arms. This ensures optimal decompression of the level and keeps the implant in place. It requires the removal of the supraspinous ligament during implantation. Biomechanical studies have shown the following effects on spine kinematics: 1) a significant reduction in the range of motion (flexion/extension) at the operated segment; 2) stabilization of partially destabilized cadaveric specimens through the range of flexion-extension and axial rotation; 3) no significant increase in the range of motion at adjacent levels compared to PLIF [44,45].

There is a lack of high-quality, randomized studies in the available literature determining the effectiveness of the DIAM. A multicenter, prospective, randomized study was conducted to assess the effectiveness of the X-STOP stabilizer in treating neurogenic claudication due to spinal canal stenosis [46]. The total population of 191 patients including a control group of 91 patients who were treated conservatively. In the surgically treated group, the implantation procedure was an isolated intervention. The Zurich Claudication Questionnaire (ZCQ) and patient satisfaction assessment were utilized. The follow-up period was 2 years. At each follow-up visit, the population treated with the X-STOP system had significantly better results in every ZCQ domain compared to the control group. Two years post-surgery, the X-STOP population showed a 45.5% improvement in the Symptom Severity domain, while the control group only had a 7.4% improvement. The average improvement in the PF domain of the X-STOP group was 44.3%, whereas in the conservatively treated group, it was only 0.4%. In the surgically treated group, 73.1% of patients were satisfied with the results, while in the conservatively treated group, it was 35.9%. The study also analyzed the impact of factors such as the straight leg raise test, comorbidities, intraoperative blood loss, PF in ZCQ, social functioning on the SF-36, range of motion in extension, range of motion in rotation, pain on the SF-36, employment status, age, L4/L5 segment occupation, presence of back pain, and opioid use on treatment outcomes. Only the first 3 factors had a significant impact: a positive straight leg raise test, absence of comorbidities, and lower intraoperative blood loss were significant prognostic factors for a good treatment outcome in the multidimensional analysis. These factors pertained to the population treated with the stabilizer, and there was no significant impact of these determinants on treatment outcomes observed in the control group. The authors of the cited study concluded that X-STOP represents an attractive alternative to decompressive surgery and conservative treatment in the management of neurogenic claudication due to spinal canal stenosis.

In the literature, information about dural sac damage during DIAM implantation has been reported in one case [47]. It occurred during a procedure where the placement of the stabilizer was an additional intervention. Additionally, excessive bleeding was observed in 13.5% of patients, infection in 0.7% of cases, and spinous process fractures in isolated cases [48]. No complications related to the DIAM system implantation were noted in two analyses [49]. In one study, the authors reported no complications but mentioned the need for reconstruction of the supraspinous ligament in 7 patients [50]. Fractures of the spinous process were demonstrated in radiological follow-up examinations in 7 patients (in a population of 1315 patients undergoing DIAM implantation as an adjunct to surgical decompression). No migration or osteolysis of the spinous process was observed in follow-up studies [51]. Minor postoperative symptoms were observed in 15.4% of patients, including restlessness and weight gain. One case of an allergic reaction to polyethylene, from which the DIAM is constructed, has been published. The reaction occurred 5 months after implantation. Severe pain subsided after removing the implant, and a foreign body reaction was confirmed upon histopathological examination [52].

Conservative methods vs. surgical treatment

The effectiveness of conservative treatment for patients with degenerative lumbar spinal disease fluctuates around 40%. In the study by Moojen et al. [53], as many as 43% of non-operatively treated patients considered the improvement after treatment to be significant. In another study, 44% of patients experienced some improvement in symptoms, while 43% experienced some improvement in physical function (PF) [54]. In this study, the procedure was effective in 32% of patients. Despite relatively stringent criteria for effectiveness, it can be suggested that the DIAM system does not surpass conservative treatment in terms of its effectiveness.

In a classic randomized, prospective study assessing the effects of surgical treatment versus conservative treatment in lumbar disc herniation, Weber et al.

[55] demonstrated a greater improvement in patient symptoms of the surgical group one year after the start of treatment – the results were statistically significant. Four years after the procedure, the results were still better in the surgically treated group, but they did not reach statistical significance. However, 10 years after the start of treatment, no differences were observed between the two groups. Nevertheless, numerous patients from the conservative treatment group eventually underwent surgery during the observational period, complicating the interpretation of long-term results.

The current prospective SPORT (Spine Patient Outcomes Research Trial) study [56,57] presents the results of treatment in patients treated surgically and conservatively. The study included 501 patients in the randomized arm and 743 in the observational arm. In each arm, there were two groups of patients – those treated surgically with standard discectomy and those treated conservatively. The follow-up period was 8 years. The inclusion criterion was lumbar disc herniation, confirmed by imaging, with radicular pain and compression of the nerve root. Primary endpoints included the Bodily Pain (BP) and PF scales of SF-36 and the AAOS/Modems Oswestry Disability Index. Secondary treatment outcomes included self-assessed improvement in symptoms, employment status, satisfaction with current health and care, and the degree of sciatic symptoms. In the fourth year of the study, patients undergoing surgery maintained better improvement in all primary endpoints compared to conservatively treated patients. Except for employment status, all secondary endpoints favored surgical intervention. In the eighth year of the study, during the analysis of results in groups according to the planned treatment, patients randomized to surgery showed slightly better, but statistically insignificant treatment effects compared to the conservatively treated group regarding the primary endpoints. However, the difference was significantly better in terms of secondary treatment outcomes, despite many cases of patient crossover between the two groups. Patients who underwent surgery maintained better primary outcomes than non-operatively treated patients. There were few cases of deterioration in the results of each group between the 4th and 8th year of follow-up. Even among patients with strong indications for surgical treatment, many (34%) remained in the conservative treatment group throughout the entire study follow-up period – 8 years [56,57].

Study limitations

The necessity of conducting comprehensive systematic or scoping reviews on the discussed topic is emphasized. The authors assert that this paper serves as a valuable overview of the current state of knowledge regarding conservative and surgical treatment options for IVD. Continuous verification of scientific data and clinical reports is imperative due to the substantial number of research publications of inadequate quality and strength of evidence. However, this review article is subject to potential methodological limitations that require attention. It takes the form of a narrative review, developed in accordance with guidelines and the Narrative Review Checklist. Nevertheless, the authors recognize that more suitable guidelines, such as PRISMA, could be employed in the future to ensure a more precise reporting of individual stages of methodology and describing the main results. The integration of standardized frameworks like PRISMA not only ensures a more meticulous reporting of methodology and results but also contributes to the ongoing refinement of research practices in the field. This adaptability to evolving standards underscores the authors' dedication to advancing the scientific discourse, promoting credibility, and ultimately enhancing the quality of patient care in the realm of IVD pathology.

Conclusions

A neurosurgery specialist, working closely with other members of the therapeutic team in the treatment process of disc degeneration, creates a team dynamic that encompasses both diagnostic and therapeutic aspects. The neurosurgeon, with expertise in surgical procedures, can precisely assess the degree of disease progression and indicate the need for surgical intervention. However, the role of the physiotherapist is equally important, especially in the conservative treatment and rehabilitation of patients with disc degeneration. This collaboration allows for a comprehensive assessment of the patient and the adaptation of the treatment plan to individual needs. As a result, the patient receives comprehensive care that includes both surgical and rehabilitation aspects, contributing to the maximization of treatment effects and improvements in QOL.

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