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Epidemiological risk factors of recurrence of lumbar intervertebral disc herniation after primary discectomy (literature review)

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Primary discectomy for a lumbar intervertebral disc herniated (LDH) is usually accompanied by a rapid regression of clinical symptoms, however, in 5–15 % of cases, an X-ray positive recurrence of the hernia with corresponding orthopedic disorders is registered, which leads to repeated surgical intervention. Objective. Determination of risk factors for recurrence of LDH and their frequency under the conditions of various methods of primary discectomy based on a scientific analysis of the relevant literature. Methods. The material of the research is articles containing the definition of risk factors for the recurrence of a LDH after primary discectomy, for the period 2013–2023 in PubMed, Google Scholar, Medline databases using medical subject headings and keywords «recurrent lumbar disc herniation, surgical interventions, percutaneous endoscopic lumbar discectomy, microdiscectomy, laminectomy, discectomy, spondylodesis». The research method is a systematic review of relevant literature sources. Results. Early and long-term results of primary discectomy for intervertebral disc herniation using decompression (open discectomy, microendoscopic discectomy, percutaneous discectomy, laminectomy, minidiscectomy, endoscopic discectomy) and decompression-stabilization (discectomy combined with spondylodesis) techniques are traced in the literature. The most successful were: 1 year after the operation — endoscopic discectomy (12.4 % of reoperations) and spondylodesis (11.8 %); 10 years after the operation — laminectomy (14 %) and spondylodesis (10 %). The highest rates of revision discectomy: 1 year after the operation — laminectomy (18.6 %); 10 years after surgery — open discectomy and endoscopic discectomy — 16 % each. Conclusions. Recurrent intervertebral disc herniation is an early complication of primary discectomy, the frequency of which varies depending on the surgical technique and the timing of the postoperative period. The most reliable risk factors are male gender, age younger than 50 years, diabetes mellitus, and smoking.

Первинна дискектомія з приводу грижі міжхребцевого диска (ГМД) поперекового відділу хребта супроводжується швидким регресом симптоматики, проте в 5–15 % випадків реєструється рентгенпозитивний рецидив грижі з відповідними ортопедичними порушеннями, що призводить до повторного хірургічного втручання. Мета. Визначення чинників ризику рецидиву грижі міжхребцевого диска поперекового відділу хребта та їхньої частоти за умов різних методик первинної дискектомії на основі наукового аналізу релевантної літератури. Методи. Аналіз фахових статей, в яких наведено визначення чинників ризику рецидиву ГМД поперекового відділу хребта після первинної дискектомії, за період 2013–2023 рр. у базах даних PubMed, Google Scholar, Medline за ключовими словами «рецидивуюча ГМД поперекового відділу хребта, хірургічні втручання, черезшкірна ендоскопічна поперекова дискектомія, мікродискектомія, ламінектомія, дискектомія, спондилодез». Результати. Відстежено ранні та віддалені результати первинної дискектомії з приводу ГМД із використанням декомпресійних (відкрита дискектомія, мікроендоскопічна дискектомія, черезшкірна дискектомія, ламінектомія, мінідискектомія, ендоскопічна дискектомія) і декомпресійно-стабілізувальних (дискектомія в поєднанні зі спондилодезом) методик. Найбільш успішними виявилися: через рік після операції — ендоскопічна дискектомія (12,4 % реоперацій) та спондилодез (11,8 %); через 10 років після втручання — ламінектомія (14 %) та спондилодез (10 %). Найвищі показники ревізійної дискектомії: через рік після операції — після ламінектомії (18,6 %); через 10 років — відкрита дискектомія й ендоскопічна дискектомія — по 16 %. Висновки. Рецидивуюча грижа міжхребцевого диска є раннім ускладненням первинної дискектомії, частота якого варіює залежно від методики хірургічного втручання та термінів післяопераційного періоду. Найбільш достовірними чинниками ризику є чоловіча стать, вік молодше 50 років, цукровий діабет, паління. Ключові слова. Первинна дискектомія, рецидив грижі міжхребцевого диска, чинники ризику.

Keywords. Primary discectomy, recurrence of intervertebral disc herniation, risk factors

Introduction

Herniated intervertebral disc (HID) of the lumbar spine (LS) occurs in 5–20 cases per 1,000 adults per year, most often in the third to fifth decade of life [1]. Surgical treatment of such patients involves open or minimally invasive removal of HID and is accompanied by a rapid decrease in the intensity of radiculalgia, the level of disability and an improvement in the quality of life [2]. However, after primary discectomy, unsatisfactory clinical results are noted in 3–19 % of cases, X-ray positive recurrence of HID in 5–15 % of observations [3], reoperation is performed in 20–24 % of patients [4–7]. Meanwhile, revision discectomy is not without additional problems due to the increased risk of neurological disorders and rupture of the dura mater due to the formation of scar-epidural fibrosis [8], the possibility of segmental instability as a result of additional removal of disc material [9, 10], significant physical and psychological stress per patient [11, 12], increasing the financial burden on the family and society [13]. Based on this, it becomes clear the need to determine risk factors and the degree of their influence on the development of recurrence of HID of the LS after primary discectomy.

Literature data on the relationship between the frequency of repeated discectomy and age, gender, body mass index, the method of primary intervention and the duration of postoperative follow-up are contradictory [14]. *Purpose:* determination of risk factors for recurrence of intervertebral disc herniations of the lumbar spine and their frequency under the conditions of various primary discectomy techniques based on a scientific analysis of the relevant literature.

Material and methods

The material of the study is professional articles that contain the definition of risk factors for recurrence of HID of the LS after primary discectomy.

The literature search was carried out in PubMed, Google Scholar and Medline databases for the period 2013–2023 using medical subject headings and keywords “recurrent herniation of the intervertebral disc of the lumbar spine”, “surgical interventions”, “percutaneous endoscopic lumbar discectomy”, “microdiscectomy”, “laminectomy”, “discectomy”, “spondylodesis”, “recurrent lumbar disc herniation”, “surgical interventions”, “percutaneous endoscopic lumbar discectomy”, “microdiscectomy”, “laminectomy”, “discectomy”, “spondylodesis”. An additional search for articles from bibliographic lists of selected publications was also carried out. If necessary, in some cases, sources of literature beyond the search period were used.

Inclusion criteria: articles on the risk factors of recurrence of monosegmental HIV of the LS after primary discectomy using different surgical techniques (open operations (isolated discectomy, laminectomy or in combination with spondylodesis), minimally invasive interventions (microendoscopic discectomy, percutaneous endoscopic discectomy)). Exclusion criteria: publications on the results of surgical treatment of polysegmental and recurrent HIV of the LS.

The research method is a systematic review of relevant literature sources.

Results and their discussion

Definition

The definition of recurrent herniated disc (rHD) varies in the literature. Some specialists define it as the appearance of a hernia at the level of the primary disc-radicular conflict (on the ipsi- or contralateral side) no earlier than 6 months after primary discectomy with eliminated radiculalgia [15, 16]. Other researchers consider HID that appeared, including at the adjacent to the initially operated level, as recurrent, and significantly reduce the time of appearance of clinical symptoms to 0.5 months. [17]. Depending on the causes of the compression syndrome, according to the results of intraoperative data of revision discectomy, a true relapse of HID and a minor relapse with epidural fibrosis more than 4 mm thick are distinguished [18].

The frequency of rHD

Recurrent HID is an early postoperative complication, the frequency of which is often related to the surgical treatment method used. According to the meta-analysis by G. Mariscal et al., in the first year after decompression surgery, the frequency of rHD of the LS in case of open discectomy varied from 1 to 12 %; microendoscopic discectomy — 1–10.8 %; percutaneous discectomy — 5.5–9.6 %; laminectomy — 6 % and open minidiscectomy — 9.2 % [19]. The overall frequency of rHD of the LS in the first year after decompression interventions is 5.2 % compared to 0.0 % after decompression-stabilization operations [20]. The authors explain the significant reduction in the risk of recurrence of HID after spondylodesis by the reduction of mechanical stress in the preserved compromised intervertebral disc due to the elimination of movements in the corresponding spinal segment, as well as the absence of disc substance in cases of almost complete discectomy [20].

Other information on the frequency of rHD of the LS after primary discectomies according to the most common methods is provided in the studies of C. H. Kim et al. [6, 21]. In patients who underwent primary surgical treatment of HID of the LS in 2003, the overall rate of revision discectomy at 5 years was 13.4 %, and half of the reoperations occurred within the first postoperative year. Reoperation rates after primary discectomy were 5.4 % at 3 months, 7.4 % at 1 year, 9 at 2 years, 10.5 at 3 years, 12.1 at 4 years, and 13.4 % at 5 years. The frequency of repeated operations was 18.6; 14.7; 13.8; 12.4 and 11.8 % after laminectomy, nucleolysis, open discectomy, endoscopic discectomy, and spondylodesis, respectively [6]. The long-term results of the primary discectomy performed in 2005–2007 revealed a slightly different distribution of the overall reoperation rate in terms of the postoperative period: 4 % at 1 year, 6 at 2 years, 8 at 3 years, 11 at 5 years, and 16 % at 10 years. The number of reoperations after 10 years was 16, 14, 16 and 10 % after open discectomy, laminectomy, endoscopic discectomy and spondylodesis, respectively [21]. In both studies, open discectomy was mostly performed (76.2 [6] and 68.9 % [21]). The frequency of reoperations 10 years after microendoscopic discectomy of HID of the LS is 9.7 % [22].

Risk factors for rHD after primary discectomy

Most researchers recognize male gender as a risk factor for rHD [1, 19, 23, 24]; only some authors did not find significant correlations between male gender and HID recurrence [17].

rHDs are mostly registered at the age of ≥ 50 years [19, 25, 26]. The frequency of reoperations after primary microdiscectomy is not related to age, but in patients older than 35 years, recurrence of HID is observed earlier in the postoperative period [27]. In isolated reports, the age of patients is not considered as a risk factor for rHD [24]. Some authors explain the higher frequency of HID recurrence in young men by the fact that the incision made during the primary intervention makes the operated disc more susceptible to sudden prolapse, especially under conditions of mechanical stress during sports or weight lifting [28].

The same contradictory information applies to the relationship between excess weight and rHD: on the one hand, the Quetelet index ≥ 25 potentiates an increase in the frequency of recurrence of HID [19, 24, 26, 29], on the other hand, the height and weight of the patient does not affect the occurrence rHD [4, 23].

Of the comorbid conditions that potentiate the increased frequency of rHD, diabetes and cardiovascular diseases are most often mentioned. A possible mechanism of hyperglycemia is the accumulation of glycation end products in the tissues of the intervertebral disc [30, 31], which leads to the disorganization of the network of collagen fibers at the border of the gelatinous nucleus and the annulus fibrosus [30], an irreversible increase in the density of collagen crosslinks [31] with a change biomechanical properties of intervertebral disc tissues. In addition, in patients with diabetes there is a decrease in the inclusion of sulfate in glycosaminoglycan molecules with a decrease in the rate of glycosylation and a weakening of the collagen matrix of the intervertebral disc [32].

The relationship between rHD and cardiovascular diseases may lie in the disruption of the trophism and biochemistry of the extracellular matrix of the gelatinous nucleus of the intervertebral disc due to the high level of triglycerides and cholesterol in the blood serum, as well as the narrowing of the LS vessel lumen by atherosclerotic plaques [33]. Recurrent HIDs are significantly more common in patients with diabetes compared to the control group [19, 24, 31, 32], but no significant correlations between rHDs and cardiovascular diseases were found [24, 34]. At the same time, there is a natural increase in the risk of rHD with an increase in the number of metabolic diseases, that is, with an increase in the comorbidity index (CI): in cases where the CI does not exceed 2, the risk of rHD increases by 11.33 %; in CI ≥ 3 by 15.31 % [35].

Smoking is considered a prognostic factor of rHD [4, 24, 34, 36–38]. The exact mechanism of the influence of tobacco smoking on the development of rHD is still not fully understood. It is believed that the defect of the annulus fibrosus and the posterior longitudinal ligament after discectomy heals under normal physiological conditions. However, toxins produced during smoking can worsen or delay these normal conditions [39]. Nicotine affects trophicity and oxygenation of the fibrous ring, replication and restoration of the nucleus pulposus of the intervertebral disc [40, 41], accelerates the degeneration of the disc with changes in its biomechanical properties [42]. The adverse effect of smoking is also manifested by an increase in intradiscal pressure due to excessive coughing and a violation of microcirculation [43]. Despite numerous evidence of the relationship between smoking and an increase in the frequency of rHD, individual publications did not reveal its significant effect on the appearance of repeated HID [23, 26, 44].

Conclusions

Recurrent intervertebral disc herniation is an early complication of primary discectomy, the frequency of which varies depending on the surgical technique and the timing of the postoperative period.

The most reliable risk factors for rHD are male sex, age younger than 50 years, diabetes, smoking.

Conflict of interest. The authors declare no conflict of interest.

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EPIDEMIOLOGICAL RISK FACTORS OF RECURRENCE OF LUMBAR INTERVERTEBRAL DISC HERNIATION AFTER PRIMARY DISCECTOMY (LITERATURE REVIEW)

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