Acta Clin Croat (Suppl. 4) 2023; 62:46-52
doi: 10.20471/acc.2023.62.s4.7

Review

THE EFFECT OD EPIDUROLYSIS IN TREATMENT OF LOW BACK PAIN – AN EVIDENCE BASED REVIEW

Jana Kogler[1], Daniel Rajačić[2] and Dino Bobovec[2]

[1]Department of Anesthesia and Intensive Care, Clinical Hospital Centre Zagreb, School of Medicine, University of Zagreb, Zagreb, Croatia
[2]Department of Surgery, Clinical Hospital Centre Zagreb, School of Medicine, University of Zagreb, Zagreb, Croatia

SUMMARY – Low back pain is the most common musculoskeletal condition in the adult population and still represents a global health problem. The initial and the most common treatment in 80% of all patients includes conservative management with pharmacotherapy for pain relief. If the symptoms persist or if there is minimal functional improvement after conservative treatment, minimally invasive interventions such as epidural steroid injections or percutaneous epidural adhesiolysis can be applied, or, in the worst cases, the patient should be considered for an open surgery procedure. Failed back surgery syndrome is a condition with a complex etiology, and many factors that predispose patients towards chronic pain. Epidural lysis of adhesions (LOA) represents an important element of the interventions for the treatment of low back pain that is refractory to more conventional methods.

Key words: *chronic low back pain; failed back surgery syndrome; epidurolysis*

Introduction

Low back pain is the most common musculoskeletal condition in the adult population and still represents a global health problem. Its prevalence has risen to as high as 84% due to the aging of the global population, and it is called "the disease of the century" due to the modern unhealthy lifestyle[1].

Low back pain is frequently classified and treated on the basis of symptom duration, with acute back pain lasting less than 4 weeks, subacute lasting 4-12 weeks and being classified as chronic if the pain persists for more than 12 weeks.

A specific origin of pain can be identified only in a small percentage of patients, with the pain being classified as non-specific in more than 90%.

Correspondence to:
Jana Kogler
Department of Anesthesiology and Intensive Care, Hospital Centre Zagreb
10 000 Zagreb, Croatia
Email: jkogler1974@yahoo.com)

During examination of the patient, in order to establish the right diagnosis and choose the appropriate treatment, it is important to determine the presence or absence of radicular symptoms and therefore corresponding anatomical or radiographic abnormalities[2,3].

Low back pain can seriously affect well-being and functioning in everyday activities. Regardless of whether the pain persists for several weeks, months or even years, there are many different and efficient pain management techniques.

The initial and most common treatment in the majority of patients includes conservative management with introduction of pharmacotherapy for alleviating pain.

Non-opioid agents, such as acetaminophen, and nonsteroidal anti-inflammatory drugs (NSAIDs) are considered the first-line therapy, bearing in mind their most common gastrointestinal, cardiovascular and hepatic adverse effects which increase with patient age, dose of the medication and duration of use.

Psychosocial factors are well-studied risk factors for developing low back pain. It has been established that

patients with a subjective perception of poor outcome are at greater risk for developing low back pain. Sense of fear combined with depression are also known negative predictors for development of chronic pain.

There are several non-pharmacologic therapies available for treating low back pain, physical therapy and exercise being the most frequently used. Other noninvasive treatment modalities include: transcutaneous electrical nerve stimulation (TENS), laser, ultrasound therapy and alternative methods (acupuncture, massage, spinal manipulation). As mentioned earlier, since the psychological component is important in chronic pain development, a commonly used nonpharmacological treatments is cognitive behavioral therapy.

If the symptoms persist or there is little or no functional improvement after conservative treatment, minimally invasive interventions such as epidural steroid injections or percutaneous epidural adhesiolysis can be applied or, in the worst cases, the patient should be considered for an open surgery procedure.

Despite advancements in technology and surgical techniques, the failure rate of spinal surgical procedures has still not decreased in the last 2 decades. It has been reported that the success rate of the 300,000 to 400,000 spinal surgeries performed per year to relieve chronic low back pain is only 50% to 60%. Residual persistent pain after spinal surgery is one of the most important and unwanted complications of invasive low back pain treatments[4].

The International Association for the Study of Pain defined the failed back surgery syndrome (FBSS) as a phenomenon of persistent or recurrent pain, mainly in the lower back and/or legs, even after previous anatomically successful spinal surgeries, and it is reported to affect between 10-40% of patients.

FBSS is a condition with a complex etiology and has many factors that predispose patients towards chronic pain. These predisposing factors can be divided into three groups: pre-, intra- and postoperative factors. Studies have shown that psychosocial risk factors have the strongest association with the development of failed back surgery syndrome[4].

Intraoperative risks for developing postoperative surgical complications include operating at either the wrong vertebral level or operating at a single level while the pain originates on several vertebral levels.

Apart from other postoperative factors (postoperative surgical bleeding, new spinal instability, myofascial pain), epidural fibrosis is the most common cause and contributing factor for persistent pain in almost 20-36 % of patients with FBSS[4,5].

Fibrous tissue in the epidural space may adhere to the dura mater and nerve roots, causing a mechanical compression of the roots or the brain layer, which may contribute to chronic low back and lower extremity pain.

Key and Ford were the first authors who studied this problem and concluded that the fibrosis originates mainly from the fibrous ring of the disc damaged during the surgical procedure or during the removal of the herniated disc. They suggested that the main source of the scar tissue was located in the anterior region of epidural space: the tissue removal of the annulus fibrosus would induce an activation of the fibroblast cells which would extend along the hematoma that invariably forms in anterior part of the canal in response to discectomy procedure (anteriorlateral fibrosis)[6].

Today, the widely accepted theory for epidural fibrosis development is the one put forward by LaRocca and MacNab, who stated that the major source of fibrosis was the inferior surface of the erector muscle of the spine[7].

Therapeutic measures for the treatment of failed back surgery syndrome can be divided into the conservative group of measures, with physical therapy or pharmacotherapy as most commonly used and more invasive methods – interventional or surgical pain management techniques. The initial treatment is always a conservative approach, as the majority of patients are expected to improve, with pain resolving in a couple of weeks. However, in severe cases of symptoms that significantly affect daily life or if the symptoms persist for more than several weeks or even longer, procedures such as epidural steroid injections or epidurolysis can be considered[8,9].

Brief history

Percutaneous epidural adhesiolysis, also known as epidural neuroplasty, neurolysis or lysis of epidural adhesions (LOA), is an interventional pain management technique that has arisen and evolved over approximately the last three decades, representing just one step in treating and alleviating chronic pain.

Although not as frequently performed as epidural steroid injection (ESI), percutaneous epidural adhesiolysis is a commonly performed procedure for the treatment of back pain secondary to failed back surgery syndrome (FBSS) and spinal stenosis.

The technique typically involves accessing the epidural space via the sacral hiatus using a large gauge needle and inserting a catheter. The catheter is then advanced to the site of adhesions, where epidurography is used to map out the adhesions, and adhesiolysis via the high-volume administration of saline and medications is performed. [10]

The goals of this procedure are not only to break down fibrous adhesions that may prevent free movement of structures in the intervertebral foramina and in the bony intervertebral canal, but also to remove any barriers or scars that prevent application of medication to structures believed to be the source of pain, and to provide targeted application of local anesthetics, corticosteroids and other agents.

The technique was subsequently modified to become an ambulatory procedure similar to a traditional ESI (Figure 1)[10].

Rationale and mechanism of action

The common premise for treating FBSS and spinal stenosis with neurolysis is that the presence of epidural fibrosis can both cause pain and prevent delivery of medications to the target location. The relationship between the presence of scar tissue and pain has been examined by multiple studies, and is still being debated[11,12].Lumbar epidural injection of long-acting steroids is commonly used by interventional pain specialists to alleviate low back pain.

Corticosteroids are well-known and effective treatment for pain due to their anti-inflammatory properties, and they traditionally act by the abolition of the rate-limiting step by the enzyme phospholipase2 to liberate arachidonic acid from cell membranes.

There are also other modes of action of corticosteroids, including membrane stabilization, inhibition of neural peptide synthesis or action, local anesthetic effect, prolonged suppression of ongoing neuronal discharge and suppression of sensitization of dorsal-horn neurons.Hypertonic saline (10%) with or without fibrinolytic enzymes such as hyaluronidase have been clinically used to dissolve the adhesion during percutaneous epidural neuroplasty to decrease the local tissue edema and improve the pain[13].

The larger the amount of volume injected, the greater the magnitude of pain relief. The proposed mechanisms of added volume not only includes adhesiolysis and washout of inflammatory cytokines, but also lavage of the epidural space, suppression of ectopic discharge from injured nerves, and enhancing blood flow to ischemic nerve roots[14].

Evidence for effectiveness

There is sufficient evidence that epidural steroid injections provide short-term pain relief, but their ability to decrease the rate of surgery is controversial. In addition, the success rate of epidural steroid injections for the treatment of radiculopathy due to lumbar disc

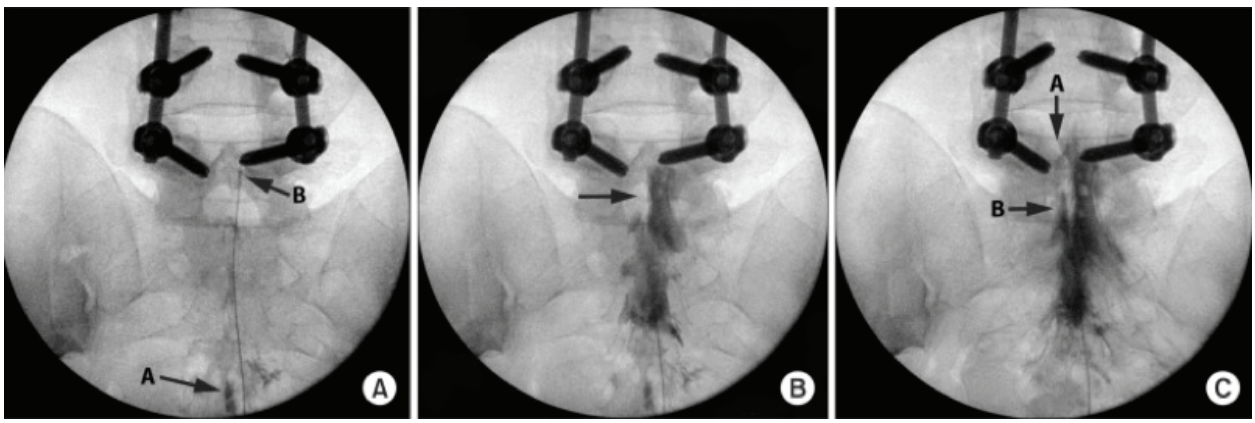

Figure 1. Sequential antero-posterior fluoroscopic images demonstrating successful epidural lysis of adhesions. (A) Arrow A illustrates the initial contrast injection demonstrating needle entry into the caudal canal. Arrow B shows the radiopaque navigable catheter inserted to the level of the hardware at the lumbar spine. (B) Initial contrast injection demonstrating filling defects on the left side and cephalad to the hardware, suggesting epidural adhesions. (C) Contrast reinjection after lysis of adhesions demonstrating improved spread cephalad (A) and to the left (B) of the initial injection pattern.

herniation varies between studies, ranging from 42% to 77%, and the rate of surgical procedures after epidural steroid injection has been reported between 10% and 25%[15].

In their study, Yang et al., concluded that the use of ESI was more effective for alleviating lumbosacral radicular pain than conservative treatments in terms of short-term and intermediate-term pain relief. However, this effect was not maintained at long-term follow-up[15,16].

Kennedy et al. found a high rate of success of ESIs at 6 months in their study, but there was also a recurrence of the symptoms during the 5-year follow-up after the injection[17].Similarly, Buchner et al. found a significant improvement in patients treated with epidural steroid injections for a very short period after the treatment, but no improvement was observed after 6 weeks and 6 months, compared with the control group who did not receive the injection[18].

Adhesiolysis was compared to physical therapy in a 2006. study by Veihelmann et al[19]. Ninety-nine patients with chronic lumbar radicular pain either with or without back pain were randomized to receive either physical therapy or a 3-day adhesiolysis protocol that included local anesthetic, steroids and hypertonic saline infused over 30 minutes. They found a statistically significant greater reductions in VAS pain scores for both back and leg pain at 3, 6 and 12 months in the treatment group compared with the control group.

Hyaluronidase and hypertonic saline

Several studies have sought to determine whether epidural administration of hyaluronidase or hypertonic saline improves outcomes. One of the first studies to examine this was by Heavner et al., whereby 83 patients were assigned to receive hypertonic saline, normal saline, normal saline and hyaluronidase, or hypertonic saline and hyaluronidase. All groups received local anesthetics and steroids during the epidural LOA. The authors found that although all groups experienced comparable improvement in pain, the 2 groups that received hypertonic saline required a lower number of treatments[13].

Another study reached different conclusions regarding the use of hyaluronidase. A small randomized study by Al-Maksoud Yousef et al. compared treatment outcomes in 38 subjects who received either fluoroscopically-guided caudal injections of 10 mL of 0.25% bupivacaine, 30 mL of 3% hypertonic saline and 80 mg of methyl-prednisolone, or the same mixture with 1,500 units of hyaluronidase added. Although significant improvements in pain and functional were noted in both groups through the 3-month follow-up, only those patients who received hyaluronidase continued to experience a benefit at 6 and 12 months post-procedure[20].

The rationale for the use of hyaluronidase in patients with FBSS relies upon its purported ability to disrupt epidural adhesions. Its primary action is to depolymerize hyaluronic acid and, to some extent, chondrotin-4 and chondrotin-6 sulfate.

When injected epidurally for pain control, hypertonic saline may reduce the cell swelling and has a local-anesthetic-like effect.

In summary, there is moderate evidence supporting the use of hypertonic saline in epidural lysis of adhesions, and weak positive evidence in favor of using hyaluronidase[20,21].

HIZ (high-intensity zone)

High-intensity zones (HIZs) are defined as a bright white signal on T2W images in the posterior annulus of the intervertebral disc and represent a fissure in the posterior annulus.

A high intensity zone generally occurs due to post-traumatic changes or the instability of the spine and degenerative changes of the disc.

HIZs may be a specific marker of discogenic low back pain because of its correlation with pain after provocation discography. The presence of HIZ and foraminal involvement of the lesion were the 2 important prognostic factors for successful treatment response[18].

The prevalence of HIZ in patients with lower back pain is between 25% and 59%, but it is also found in 6-33% of asymptomatic patients.

These reports support the notion that location of the HIZ may be the main lesion for inflammation that causes pain in symptomatic patients, thus making it the direct target of delivery of local anesthetics and steroids by percutaneous epidural adhesiolysis, which may contribute to the superior outcome[22,23].

Different approach

The three most frequently used types of epidural treatments treat pain in different locations of the body: the caudal, transforaminal and interlaminar approach.

These 3 approaches utilize different techniques with certain advantages and disadvantages, with potentially different outcomes based on the level of structural abnormalities.

The midline interlaminar approach is considered easy and safe, but the spread of injectate into the lateral and ventral epidural spaces may be limited due to the presence of epidural ligaments or scar tissue. The transforaminal approach is the most target-specific, requiring the smallest volume to reach the primary site of pathology.

In contrast, caudal epidural injections require relatively large volumes and are associated with an alleged lack of specificity to the assumed site of pathology. Regardless, it is considered the safest and easiest approach[24].

A paper by Manchikanti et al. analyzed data from 3 randomized controlled trials that assessed a total of 360 patients with lumbar disc herniation.

The results of a 2-year follow-up of 3 randomized, double-blind, controlled trials, with a total of 360 patients with chronic persistent pain of disc herniation receiving either caudal, lumbar interlaminar or transforaminal epidural injections showed similar efficacy of the 3 techniques with local anesthetic alone or local anesthetic with steroids[25].

Duration of the protocol

Two main approaches for performing percutaneous adhesiolysis include the 1-day and 3-days methods. The primary method of adhesiolysis introduced by Racz included a 3-day period with the catheter in the epidural space and with injection of a different drug every day. Subsequently, Manchikanti et al. changed this method and suggested a 1-day outpatient method. In this method, the catheter was removed immediately after drug injection and the patient was discharged[26,27]

A large retrospective trial by Manchikanti et al. conducted both ambulatory and two-day adhesiolysis protocols in a total of 129 patients[28]. The results of the two protocols were compared to each other and to previously reported results with Racz's three-day protocol. Both treatments were associated with good short-term relief with no differences noted between protocols.

To our knowledge, only one study has compared the results and complications of these 2 methods, the study from Hossieni et al., in which the authors recommend using the 1-day technique due to the decreased duration of the procedure and hospital stay, which is associated with less patient discomfort and treatment cost given that the final results of the 2 methods were statistically identical and both protocols had high safety[29].

Surgical versus non-surgical treatment

Non-surgical interventions are almost always initially recommended in the treatment of patients with low back pain, but surgery is generally considered the gold standard. Only a few studies have compared surgical and non-surgical treatments, and study findings are inconsistent[30].

Zaina et al.[31] concluded that they had very little confidence whether surgical treatment or a conservative approach was better for lumbar spinal stenosis with no new recommendations to guide clinical practice. However, it should be noted that the rate of side effects ranged from 10% to 24% in surgical cases, and no side effects were reported for any conservative treatment.

Conclusions

The evidence regarding epidural lysis of adhesions is still controversial. Although randomized studies seem to indicate that neurolysis is superior to conventional ESI and conservative therapy, many of these studies were conducted by the same groups of investigators and suffer from significant methodological flaws.

The mechanisms of action for epidural LOA probably include the dissolution of scar tissue, the washout of inflammatory cytokines by high volume injectates, and the suppression of ectopic discharge from injured nerves.

Very little has been studied about the factors associated with outcomes for epidural LOA. Identifying the ideal patients and technique for epidural LOA is important factor contributing to the favorable outcome of the procedure.

Conflict of interest:
The authors declare no conflict of interest to disclose.

Financial disclosure:
The authors declare no competing financial interests. This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Data availability:

The datasets generated during and/or analyzed during current study are available from the corresponding author upon reasonable request.

References

1. Hoy D, Bain C, Williams G, et al. A systematic review of the global prevalence of low back pain. Arthritis Rheum. 2012;64: 2028-37.
2. Wu A, March L, Zheng X, Huang J, Wang X, Zhao J, et al. Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. Ann Transl Med. 2020 Mar;8(6):299.
3. Driscoll T, Jacklyn G, Orchard J, et al. The global burden of occupationally related low back pain: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis. 2014;73:975-81.
4. Thomson S. Failed back surgery syndrome - definition, epidemiology and demographics. Br J Pain. 2013 Feb;7(1):56-9.
5. Wilkinson HA. The Failed Back Syndrome: Etiology and Therapy. Philadelphia: Harper & Row, 1991.
6. Key JA, Ford LT. Experimental intervertebral-disc lesions. J Bone Joint Surg Am. 1948;30A(3):621-30.
7. LaRocca H, Macnab I. The laminectomy membrane. Studies in its evolution, characteristics, effects and prophylaxis in dogs. J Bone Joint Surg Br. 1974;56B(3):545-50.
8. Rainville J, Nguyen R, Suri P. Effective Conservative Treatment for Chronic Low Back Pain. Semin Spine Surg. 2009 Dec 1;21(4):257-63.
9. Petersen T, Kryger P, Ekdahl C, et al. The effect of McKenzie therapy as compared with that of intensive strengthening training for the treatment of patients with subacute or chronic low back pain - A randomized controlled trial. Spine. 2002;27:1702-9.
10. Lee F, Jamison DE, Hurley RW, Cohen SP. Epidural lysis of adhesions. Korean J Pain. 2014 Jan;27(1):3-15. doi: 10.3344/kjp.2014.27.1.3.
11. Trescot AM, Chopra P, Abdi S, Datta S, Schultz DM. Systematic review of effectiveness and complications of adhesiolysis in the management of chronic spinal pain: an update. Pain Physician. 2007;10:129-46.
12. Ii SH, Benyamin RM, Chopra P, Deer TR, Justiz R. Percutaneous adhesiolysis in the management of chronic low back pain in post lumbar surgery syndrome and spinal stenosis: a systematic review. Pain Physician. 2012;15:E435-E462.
13. Heavner JE, Racz GB, Raj P. Percutaneous epidural neuroplasty: prospective evaluation of 0.9% NaCl versus 10% NaCl with or without hyaluronidase. Reg Anesth Pain Med. 1999;24:202-7.
14. Rabinovitch DL, Peliowski A, Furlan AD. Influence of lumbar epidural injection volume on pain relief for radicular leg pain and/or low back pain. Spine J. 2009;9:509-17.
15. Yang S, Kim W, Kong HH, Do KH, Choi KH. Epidural steroid injection versus conservative treatment for patients with lumbosacral radicular pain: A meta-analysis of randomized controlled trials. Medicine (Baltimore). 2020 Jul 24;99(30):e21283.
16. Bhatia A, Flamer D, Shah PS, et al. Transforaminal epidural steroid injections for treating lumbosacral radicular pain from herniated intervertebral discs: a systematic review and meta-analysis. Anesth Analg. 2016;122:857-70.
17. Kennedy D, Zheng PZ, Smuck M, McCormick ZL, Huynh L, Schneider BJ. A minimum of 5-year follow-up after lumbar transforaminal epidural steroid injections in patients with lumbar radicular pain due to intervertebral disc herniation. Spine J. 2018;18:29-35.
18. Buchner M, Zeifang F, Brocai DR, Schiltenwolf M. Epidural Corticosteroid Injection in the Conservative Management of Sciatica. Clin Orthop Relat Res. 2000;375:149-56.
19. Veihelmann A, Devens C, Trouillier H, Birkenmaier C, Gerdesmeyer L, Refior HJ. Epidural neuroplasty versus physiotherapy to relieve pain in patients with sciatica: a prospective randomized blinded clinical trial. J Orthop Sci. 2006;11:365-9.
20. Yousef AA, EL-Deen AS, Al-Deeb AE. The role of adding hyaluronidase to fluoroscopically guided caudal steroid and hypertonic saline injection in patients with failed back surgery syndrome: a prospective, double-blinded, randomized study. Pain Pract. 2010 Nov-Dec;10(6):548-53.
21. Kim SB, Lee KW, Lee JH, Kim MA, An BW. The effect of hyaluronidase in interlaminar lumbar epidural injection for failed back surgery syndrome. Ann Rehabil Med. 2012;36:466-73.
22. Kim SB, Lee KW, Lee JH, Kim MA, Kim BH. The additional effect of hyaluronidase in lumbar interlaminar epidural injection. Ann Rehabil Med. 2011;35:405-11.
23. Jha SC, Higashino K, Sakai T, Takata Y, Abe M, Yamashita K, et al. Clinical Significance of High-intensity Zone for Discogenic Low Back Pain: A Review. J Med Invest. 2016;63(1-2):1-7.
24. Wang ZX, Hu YG. Factors associated with lumbar disc high-intensity zone (HIZ) on T2-weighted magnetic resonance image: a retrospective study of 3185 discs in 637 patients. J Orthop Surg Res. 2018 Dec 4;13(1):307.
25. Racz GB, Day MR, Heavener JE, Smith JP. "The Racz Procedure: Lysis of Epidural Adhesions (Percutaneous Neuroplasty)." Comprehensive Treatment of Chronic Pain by Medical, Interventional, and Integrative Approaches, Ed. Tim Deer. Springer, 2013.
26. Manchikanti L, Singh V, Pampati V, Falco FJ, Hirsch JA. Comparison of the efficacy of caudal, interlaminar, and transforaminal epidural injections in managing lumbar disc herniation: is one method superior to the other? Korean J Pain. 2015;28(1):11-21.
27. Manchikanti L, Pampati V, Fellow B, et al. Role of one day epidural adhesiolysis in management of chronic low back pain: a randomized clinical trial. Pain Phys. 2001;4:153-66.
28. Manchikanti L, Pakanati R, Bakhit C, et al. Role of adhesiolysis and hypertonic saline neurolysis in management of low back pain: evaluation of modification of the Racz protocol. Pain Digest. 1999;9:91-6.
29. Hossieni B, Dadkhah P, Moradi S, Hashemi SM, Safdari F. The Results of Treating Failed Back Surgery Syndrome by

Adhesiolysis: Comparing the One- and Three-Day Protocols. Anesth Pain Med. 2017 Aug 22;7(5):e60271.

30. Negrini S, Zaina F, Romano M, Atanasio S, Fusco C, Trevisan C. Rehabilitation of lumbar spine disorders: an evidence-based clinical practice approach. In: Frontera WR, Delisa JA, Gans BM, Walsh NE, Robinson LR editor(s). DeLisa's Physical & Rehabilitation – Principles and Practice. 5th Edition. Baltimore, Maryland: Lippincott Williams & Wilkins, 2010:837-82.
31. Zaina F, Tomkins-Lane C, Carragee E, Negrini S. Surgical versus non-surgical treatment for lumbar spinal stenosis. Cochrane Database Syst Rev. 2016 Jan 29;2016(1):CD010264.

Sažetak

UČINAK EPIDUROLIZE U LIJEČENJU KRIŽOBOLJE − PREGLED UTEMELJEN NA DOKAZIMA

J. Kogler, D. Rajačić i *D. Bobovec*

Križobolja najčešći je mišićno-koštani entitet u odrasloj populaciji i još uvijek predstavlja globalni zdravstveni problem. Početno i najčešće liječenje u 80 % svih bolesnika uključuje konzervativno liječenje uz farmakoterapiju za ublažavanje boli. Ako simptomi potraju ili poboljšanja nisu dovoljna, mogu se primijeniti minimalno invazivne intervencije kao što su epiduralne injekcije steroida ili perkutana epiduralna adhezioliza ili u najgorem slučaju pacijenta treba smatrati kandidatom za operaciju. Sindrom neuspjelog kirurškog zahvata na leđima je stanje sa složenom etiologijom i mnogim čimbenicima koji predisponiraju pacijente za kroničnu bol. Epiduralna liza adhezija (LOA) predstavlja važan dio intervencijskog repertoara za liječenje križobolje koja je otporna na konvencionalnije tretmane.

Ključne riječi: *kronična križobolja, sindrom neuspješne operacije leđa, epiduroliza*