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Mini Review Article

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Epidural Steroids Injection: A Mini Review

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Introduction

Low back pain is a major cause of morbidity and disability leading to economic, social, and health burdens worldwide; as it is considered the fifth most common cause to seek medical care, the most common cause of disability in the United States (US), and here in Germany the second most common cause of disease burden according to Robert Koch Institute (RKI) [1,2]. It is also considered as the fifth most common cause to seek medical care in US, with a lifetime prevalence that ranges from 11% - 84%, leading to economic, social, and health burdens [3]. Related healthcare costs fluctuate from 30 to 50 billion US Dollars in the US [4]. Furthermore, neck pain is considered the 6th most common cause of disability in the US; with an estimated annual prevalence of 30% to 50% for chronic neck pain [1,5]. Both of the aforementioned diseases result in high rates of morbidity and decreased quality of life (QoL).

One of the major causes of neck and back pain is radicular pain, which is defined as pain that radiates from the nerve root along the pathway of the nerve [6,7]. It could be caused by either nerve mechanical compression and/or inflammation [7]. Multiple causes

of nerve root compression were reported in the literature such as disc herniation, spinal canal stenosis, foraminal stenosis, or nerve root cyst, etc. On the other hand, nerve inflammation is mediated by multiple inflammatory mediators including phospholipase A2, and tissue necrosis factor-alpha that increase the sensitivity of the nerve and cause severe pain [4,7].

Management of radicular pain includes conservative measures, epidural injections, and surgeries. Conservative measures include pain medication, physical therapy, and lifestyle modification. Epidural Steroid Injection (ESI) can be used as a treatment solution when other conservative methods are failed [8]. ESI was first described in 1952 by Robecchi and Capra [9]. It is a non-surgical treatment in delivering a combination of steroids with or without local anesthetics directly into the epidural space with various approaches such as interlaminar, transfacet, and transforaminal. The mechanism of Action (MoA) is mainly anti-inflammatory, anti-edematous, and increasing neuronal membrane stability. ESI is considered a rapid solution for relieving pain and increasing quality



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of life [7,10]. With the advent of imaging modalities in the 1990s, guided injections were introduced, aiding in increasing its clinical use, efficacy, and safety. Consequently, the number of ESI from 1994 to 2001 increased by 271% [5,11].

In this review article, we will discuss the Epidural Steroid Injection (ESI) role in the management of radicular pain, indications, complications, outcomes, and prognosis.

Indications

The most common cause of radicular pain is intervertebral disc pathology, which is one of the major indications for this procedure [12]. In addition, many pathologies may benefit from epidural steroid injections, such as:

- Spinal stenosis [11,13]
- Sciatica; patients with sciatica who took epidural steroid injections showed improvement in pain and disability, mostly, in the short-term outcomes [14,15]
- Pain management following spinal surgeries. The administration of epidural steroids is a good option for reducing post-spinal surgery pain since steroids reduce immediate and late pain that is associated with peridural fibrosis [16]
- Short term relief of acute neuropathic pain, ESI was effective for both nociceptive and neuropathic pain, therefore ESI could treat the neuropathic pain component in patients with low back pain [17,18]
- Failed Back Surgery Syndrome (FBBS) [6]
- Facet Joint Syndrome [6]
- Percutaneous adhesiolysis [9]
- Diagnostic (Nerve block) [4]
- Thickening of ligamentum flavum [12]

- Radiculitis.
- Post-herpetic or post-traumatic neuralgia [12].
- Spondylosis and Spondylolisthesis (ESI has inferior clinical outcome and pain reduction in comparison to the surgical intervention) [19].

Approach

The approach is mainly dependent on the anatomical location of the treated area, thus it is divided according to the vertebral column divisions: Cervical, Thoracic, and Lumbar.

Cervical

Mainly, the cervical approach can be divided into two approaches: interlaminar, transforaminal, and indirect.

Interlaminar

Herein, the needle is advanced directly toward the epidural space throughout the ligamentum flavum, the loss of resistance technique (LOR) is being used as a mark point to identify the epidural space, offering a direct approach in delivering the medication. It is recommended hypothetically to inject between C7-T1 to obviate any dural puncture or spinal injury, while the posterior epidural space is estimated to be more than 2 mm, thus giving more space in placing the needle [6,20] In contrast, a non-statistically significant association was reported regarding the dural puncture between the other cervical levels [20]. Although, it is recommended to use an air-filled syringe instead of saline during LOR technique. Principally, the interlaminar approach is not commonly performed, to avoid any direct injury to the spinal cord or dural puncture [7]. However, some experienced physicians prefer to use it, due to its reported effectiveness and safety in literature in some cases [6,20]. Furthermore, it carries a low risk of vascular catheterization in comparison to the transforaminal approach [6,7].



Figure 1: Anterior-lateral transforaminal cervical approach.



Figure 2: Posterior-lateral transforaminal cervical approach.

Transforaminal

This approach is rarely used and is not preferred by physicians, the needle is advanced through the vertebral foramina, specifically to the posterior and lateral part of the vertebral foramen; either anterior-laterally (Figure 1.) or posterior-laterally (Figure 2.), the latter is more preferably used as it has a lower possibility of vascular injury [21]. Moreover, it carries a higher possibility of an inadvertent vascular injury especially injury to the radicular, deep, and ascending cervical arteries. Some literature suggests Ultrasound-guided injection to avoid vascular injury, however, it has no role in showing the bony structure. Therefore, it should be done undoubtedly under image guidance by an experienced physician [22]. Otherwise, the patient will be at risk of serious but rare side effects such as stroke or spinal cord ischemia. These complications are believed to be due to injecting the particulate steroids into a vascular structure that, in turn, leads to embolization in the vessel (Figure 1. And Figure 2).

Indirect

In this novel approach, a needle is inserted posteriorly to the dorsal facet joint allowing the injected materials to disperse indirectly to the extra or intraforaminal area of the nerve root. Hence, avoiding injury to some critical vascular structures such as nerve roots, vertebral and carotid arteries, and the jugular vein. It exhibits safe and promising results [21,22].

Lumbar

In the lumbar division of the vertebral column, epidural steroid injections can be administered through: interlaminar transforaminal, and transfacet approaches.

Interlaminar

The needle is advanced directly through the ligamentum flavum into the epidural space. This method is used to treat axial pain in the first place. In addition, it is sometimes used in treating radicular pain. Compared to the transforaminal approach, it allows

the injection of a higher volume of the medication.

Transforaminal

The needle is advanced posterolaterally until it reaches the posterior part of the foramen (Figure 3). It can be used as a diagnostic method by injecting local anesthetics around the suspected nerve root (Nerve block), additionally, it is efficient in the treatment of radicular pain; some reports support its superiority to treat radicular pain in comparison to interlaminar and caudal approaches [4,23]. Furthermore, it could be considered a surgery-sparing intervention [4] (Figure 3).



Figure 3: Posterior-lateral transforaminal lumbar approach.

Trans-facet

The needle is inserted directly between the facet joints. It is considered an ideal approach for patients who are taking antiplatelet therapy, as the targeted area is avascular, thus it can help in avoiding any bleeding-related complications, making it the ideal choice for those patients.

Technique

It relies on the chosen approach; however, it often starts by taking the measurements under the imaging modalities and marking the intended area of treatment, followed by applying subcutaneous anesthesia slowly, then the injected needle is advanced to the intended position followed by injecting 1 ml of non-ionic contrast. Finally, before injecting the medication, a control image is done again to ensure the right position of the needle and the diffusion of the contrast flow.

Outcomes

Despite being used in the conservative management of many disorders for decades now, the efficacy of epidural steroid injections use is still questioned, and the data and literature regarding this procedure are contraindicatory and inconsistent, this might be because of the efficacy of this procedure varies between different pathologies, different approaches, and most importantly different patients' characteristics. It is well established that this procedure is beneficial for some pathologies; when administered to the right patients at the right time [13,18].

When discussing the benefits of this procedure for back pain in a time-wise manner, most of the studies concur that the beneficial effects of epidural steroid injections are more prominent in the short and middle terms, with special regard to improving pain and disability, but not necessarily improving eventual outcomes, some even argued that the use of this procedure may result in surgery delay due to the temporary symptomatic relief, at the other side it may lead to omitting the surgical intervention at all [24].

It is worth mentioning that procedures' benefits are limited in the immediate terms and that the full benefits of the injection may take 1-3 days to manifest, and may take up to 1 week in some cases [25]. With regard to patients with cervical radiculopathic pain, Manchikanti et al, reported clinical improvement in over 60% of those who have received transforaminal epidural steroid injection [26].

The evidence of some clinical improvement was somehow clear with regard to the improvement in lower back pain. Pandey et al, found that clinical improvement after one year of injection for the prolapsed lumbar intervertebral disc was 90% for the transforaminal route, 77.7% in the interlaminar route, and 74.3% for the caudal route [27]. Many studies showed similar results of the benefit of epidural steroid injections in comparison with placebo injections for radicular back pain [28-31]. However, the evidence regarding the long-term benefits of this procedure is rather unclear, and further studies are needed to determine the effect, one study by Curatolo et al, have determined that the long-term effects of epidural spinal injection in lumbar spinal disease were unlikely to be related to the effects of the injection by itself, but are related to other factors like the placebo effect, regression to the mean, and the natural history of the disease [32].

Complications

Generally, epidural steroid injections are considered a well-tolerated and safe procedure. In a study that included 4265 patients

who received epidural steroid injections, Jacob M. McGrath et al, determined that the rate of complications for this procedure is about 2.4% [33].

It is worth mentioning that transforaminal injections carry a lower risk of complications than interlaminar injections, also using non-particulate steroid injections is associated with a lower side effects profile [13].

The complications could be divided into 2 main entities: injection related, and steroids related.

Regarding injection-related complications [34]:

- Increased pain
- pain at the site of the injection
- Headache
- Nerve injury
- Bleeding and epidural hematoma
- Vascular injury
- Dural Puncture
- Local infection and epidural abscess
- Brain and spinal cord infarctions (rare)
- Paralysis (rare)
- Vertebral osteomyelitis (rare) [35]
- Corticosteroid side effects:
- Iatrogenic Cushing syndrome [13]
- Adrenal insufficiency [36]
- Flushing, especially in females, patients receiving dexamethasone, and those who received intralaminar injections [37]
- Hyperglycemia; especially in diabetics [38]
- Abnormal uterine bleeding [39]
- Emboli formation especially with a vascular puncture when using the non-particulate steroid. [36]

Conclusion

Epidural steroid injection is an effective method for treating spinal pain that is associated with many spinal pathologies. It is considered an excellent, cost-efficient, safe and relatively effective method to treat progressive pain that is not associated with progressive neurological dysfunction and when urgent surgical intervention is not indicated [34]. Epidural steroid injections' short-term effect is well-known to be beneficial and to improve outcomes, however the long-term effects and outcomes should be further investigated.

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To our beloved newborn Ahmad Mohamed Mulhem Arouss.

Conflict of Interest

No Conflict of interest.

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