Single-shot epidural injections in the management of radicular pain

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Abstract

Epidural injections are commonly used in the treatment of chronic low back pain due to symptomatic lumbar spinal disorders. The aim of the present investigation was to study their therapeutic value for different age subgroups. A consecutive series of 356 patients were treated with at least one injection, and assessed before and after injection. Significant pain reduction was observed in all age groups following a series of injections with the greatest reduction after the first one. Especially in patients younger than 50 years, pain medication could be reduced substantially. Surgery was performed in 19.4% of patients (n=69) following a series of SSPDA injections. In the current study, interlaminar steroid injections for treatment of chronic low back and radicular pain caused sufficient improvement and significant reduction of medication especially in younger patients.

Introduction

Chronic back pain and its associated disabilities is one of the most common of all chronic pain disorders and thus an important health care problem. The lifetime prevalence of spinal pain has been reported to be as high as 54 to 80%.[1] Annual prevalence of low back pain ranges from 15 to 45%.[2] Previous investigations of the prevalence of low back pain and neck pain and their impact on general health have shown that 25% of patients with low back pain complain of intense pain with disability to work; in patients with neck pain, the proportion ranged around 14%. Therefore spinal pain is associated with enormous economic, societal, and health impact.[3]

Intervertebral discs, facet joints, ligaments, fascia, muscles, and nerve root dura as tissues capable of transmitting pain have been identified as causes of low back pain. In addition, inflammation of the nerve root seems to be an important factor in the pathophysiology of radicular and discogenic pain.[4-6] However, the pathophysiology of spinal radicular pain is the subject of ongoing research.

No conservative or surgical intervention provides definite and long-term improvement in chronic low back pain. To manage this disorder, epidural injection is one of the most commonly performed intervention, especially in the therapy of radicular pain.[7] Three different approaches can be used to reach the lumbar epidural space, namely, interlaminar, transforaminal and caudal.[1,8-10] Each of them has certain advantages and disadvantages; which is preferable is still a matter of controversy.

This is also the case regarding the medical necessity and indications of such injections. On this issue, a great number of systematic reviews, studies guidelines have been published, but the evidence is highly variable,[11-15] and the benefit uncertain.

In light of this situation, the aim of the present investigation was to study the short-term therapeutic value and safety of interlaminar single-shot epidural injections without using an epidural catheter for some days.

Materials and Methods

The study included retrospectively a consecutive series of 356 patients recruited from a spine specialist who had been managed with single-shot epidural injection. None of the patients received an epidural catheter.

The inclusion criteria were as follows: clinical evidence of radicular pain that lasted despite at least 6 weeks of conservative management and magnetic resonance imaging (MRI) confirmation of pathology. The MRI findings were evaluated in collaboration with an experienced MRI radiologist.

The patients with incomplete charts were excluded. Follow up data were obtained retrospectively.

In order to assess differences between age groups, the collective was divided into three different age subgroups (group 1: <50 years; group 2: 50-70; group 3: >70).

All SSPDA injection procedures were performed as previously described under inpatient conditions without premedication in an operating theatre.[16] In all cases, the interlaminar approach to level L3/4 was practiced using the loss-of-resistance technique. During this procedure, up to 10 mL of saline solution was drawn into the syringe while continuous or intermittent pressure was applied towards the epidural space. On entry into the epidural space, the syringe contents were injected at loss of resistance. Satisfactory localization was followed by slow injection of treatment agent containing a mixture of 2% ropivacain, 40 mg sufentanildihydrogencitrat and 10 mg triamcinolone-fluorhydroxyprednisolone.

The parameters recorded before injection included gender, age at injection, clinical symptoms, etiology of low back pain, number of previous surgeries and the visual analogue scale (VAS) for low back pain. Every further injection was documented. The outcome measure change in VAS (*i.e.* the difference between pre-injection and post-injection score; the greater the reduction in the score, the better the outcome) was recorded at day one after the injection and after every further injection. Furthermore, subjective benefit, need for further surgeries and reduction of pain medication were recorded.

All data were analyzed by a statistical consultant using SPSS 16.0 (SPSS, Chicago, IL, USA). Categorical variables are given as the number of events and percentage. The Chi-Square-Test was used to compare the different categorical variables. Comparison of mean values was performed with the use of T-test for pair samples. Normal distribution was tested with the Kolmogorov-Smirnov test with a level of significance of $P<0.05$.

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Results

Three hundred and fifty-six patients from one institute with low back pain and radicular pain were entered in the study (women n=195; men n=161). The age distribution of the different clinical symptoms is shown in Table 1.

Indications for epidural infiltration were as follows. Age related indications for epidural infiltration are demonstrated in Figure 1. They were as follows: herniation disc (a); spinal canal stenosis (b); degenerative changes like osteo-chondrosis and arthrosis of the facet joints (c); degenerative lumbar scoliosis (d); failed back surgery syndrome (e); spondylolisthesis (f); multifocal caused lumbar back pain (g); facet joint cyst (h); others (i).

Most of the patients received three consecutive series of SSPDA injections (1 injection: n=6, 1.7%; 2 injection: n=43, 12.1%; 3 injection: n=307, 86.2%). No age-related statistical significant difference was observed in this respect (P=0.844). In particular, and in addition to SSPDA injections, 25.3% (n=90) of patients received infiltration of the facet joints, whereby no age-related difference could be observed. Infiltration of the facet joint was only performed in those with degenerative changes of the affected articulation. Within the group of patients with facet joint infiltration, the predominant level was L4/L5 (n=59; 16.6%) followed by L5/S1 (n=14; 3.9%) and L3/L4 (n=7; 2.0%).

Ninety-seven percent of the patients were very satisfied (n=65; 18.3%), well satisfied (n=189; 53.1%) and satisfied (n=82, 23%) and would undergo the procedure again. Within these groups, no age-related significant difference was observed. Later surgery due to resurgent pain was performed after a minimum of six months in 19.4% of patients (n=69) following a series of SSPDA injections. Nevertheless, the rate was higher in patients older than 70 years (n=27; 25%) compared to the other age groups (group 1: n=23; 17%; group 2: n=19; 16.6%), but without significant differences.

In all age groups, pain reduction was observed following a SSPDA series. In group 1, subjective intensity of pain decreased from a median value of 7 [standard deviation (SD) 2.8] before the injection to 2,5 (SD 2.5) (P=0.0001), in group 2 from 6.5 (SD 2.3) to 2.0 (SD 2.0) (P=0.0001) and in group 3 from 6.0 (SD 3.1) to 2.0 (SD 2.0) (P=0.0001). For the different injections, the benefit in pain reduction increased with every further injection, but the extent of reduction was greatest after the first injection (Figure 2). No statistical correlation was observed between the different age groups (r=0.094).

Reduction of pain medication after the injection was also considered: 36.4% (n=120) were able to reduce their medication after the SSPDA intervention. In 9.6%, no further medication was necessary. The greatest reduction was seen in patients younger than fifty years. In this group (n=121), 50.4% reported a significant reduction while 19% (n=23) reported that no further pain medication was necessary within one year.

Discussion

In this study, we evaluated the short-term effectiveness of epidural injections without using epidural catheter in patients with chronic low back and radicular pain.

In all age groups, a significant reduction of

Table 1. Age-related clinical symptoms.

	Lumbago		Lumbosciatica		Sciatica	
	N.	%	N.	%	N.	%
<50 years	32	38.1	94	37.6	9	40.9
51-10 years	25	29.8	84	33.6	5	22.7
>70 years	27	32.1	72	28.8	8	36.4
Total	84	100	250	100	22	100

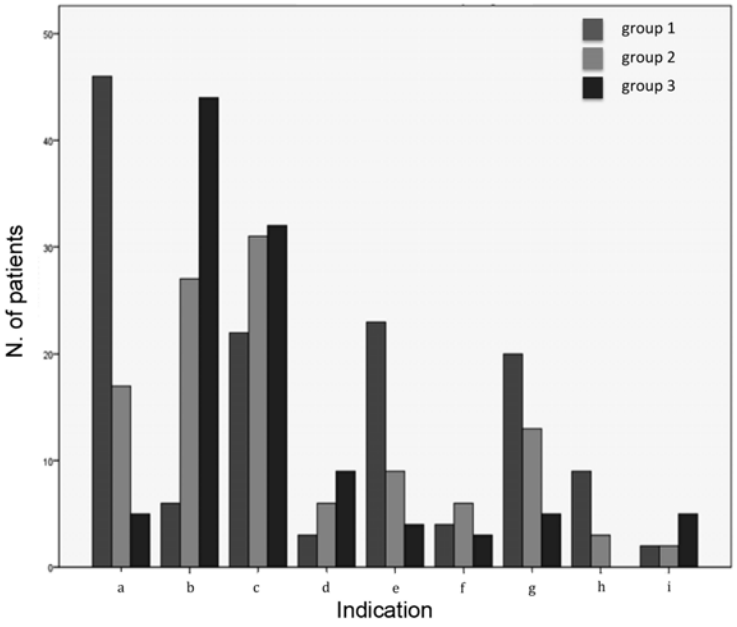

Figure 1. Age-related indications for epidural infiltration: herniation disc (a); spinal canal stenosis (b); degenerative changes like osteo-chondrosis and arthrosis of the facet joints (c); degenerative lumbar scoliosis (d); failed back surgery syndrome (e); spondylolisthesis (f); multifocal caused lumbar back pain (g); facet joint cyst (h); others (i)

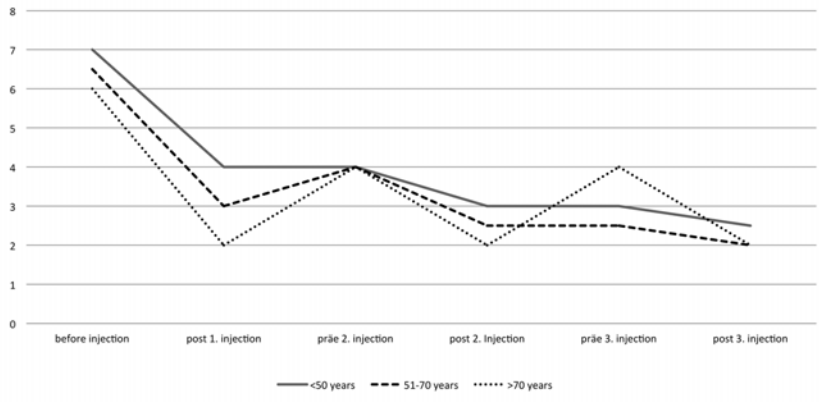

Figure 2. Pain reduction during the course of hospitalization.

pain was observed after single-shot epidural infiltration with subsequent reduction of pain medication. These results are in line with previous investigations and systematic reviews,[7,14] but this issue remains controversial.[12] The divergence of opinion may be attributable to different study designs. Some authors have evaluated the evidence based on the route of administration, namely caudal, transforaminal, or lumbar interlaminar, and found a positive impact, others have evaluated the impact by combining multiple conditions and techniques into one category, leading to wrong conclusions.[11,17]

In the present study, we used the lumbar interlaminar way of application in all patients. This approach allows to inject the solution close to the site of pathology. Thus, in comparison with the caudal approach, smaller volumes are required to reach the primary site of pathology in the anterior-lateral epidural space and in the dorsal root ganglion. In comparison with the transforaminal approach, favored by most physicians, results seem to be inferior, according to previous clinical trials.[18,19] However, other trials found that the route of injection is probably immaterial as long as sufficient volume is used to distribute the fluid to the desired level. Furthermore, some authors recommend to perform the injection at the most stenotic intervertebral level to provide maximum pain relief.[20] With regard to the complication rate which we did not assess, the three different approaches have been found to be comparable.[21,22]

Similar to the controversy on the best approach, the debate continues on the underlying mechanism of epidurally administered steroid and local anesthetic injections.[14] It is supposed that the local anesthetics interrupt the pain-related spasm cycle and reverberating nociceptor transmission. Furthermore the resulting neural blockade alters or interrupts the nociceptive input, reflex mechanisms of the afferent fibers, self-sustaining activity of the neurons and the pattern of central neuronal activities.

Furthermore, saline injections may work either by lavage of the epidural space or by a mechanical effect. The fluid leads to lysis of neural adhesions and possibly to anesthesia from decompressive effects. Some authors embraced this idea, and claimed that large volume epidural injections are more effective.[23] However, they were found to be painful and, possibly, to cause headaches and dizziness.[24] In this context, two cases of intraocular hemorrhage after rapid epidural injection of 120 mL of saline have been reported.[25] Therefore, a middle way must be found as suggested by Harley who showed that an epidural injection of 6 mL contrast medium through the L4/L5 interspace spreads up to the level of L1 and down to S5. Based on these results, 10-mL injections, as used in the present study, seem to be more than sufficient to reach the areas involved in most disc derangements. With regard to the possible mechanical pain reducing effect of the administered solution, bolus infiltration seem to be the better approach compared to continuous administration by an epidural catheter. In this context previous investigations, especially those examined the pain reduced effect during childbirth, demonstrated that bolus injection results in better distribution of anesthetic solution in the epidural space compared with continuous infusion of the same anesthetic solution.[26] However, how far this observation could be translated to management of chronically low back pain is not sufficiently clarified.

Beside these effects, the administered corticosteroids reduce inflammation by inhibiting the synthesis or the release of proinflammatory mediators like tumor-necrosis factor alpha, prostaglandine and phospholipase.[27]

In conclusion, previous investigations demonstrated that epidural steroid infiltration, like performed in the present investigation, seems to be superior to placebo for treating radicular symptoms as well as chronically low back pain.[28] In patients with chronically radicular symptoms and low back pain, there is good evidence that a single steroid infiltration has similar efficacy as a single injection of bupivacaine or saline.[29] However, we believe that combination of the anti-inflammatory effect of steroids together with local anesthesia related interruption of pain-related spasm cycle and reverberating nociceptor transmission and the mechanical effect of the correct volume caused by the addition of saline fluid is the best solution for the patient. Nevertheless, further investigations are needed to define the ideal number of injections. In our cohort, following a series of SSPDA, surgery was required in 19.4% of the patients, a rate reported in previous investigations (10%).[19] With regard to the outcome, our results seem to be better than those of previous studies with an *effectiveness* of over 90%,[18,19] compared for example with Buttermann *et al.* who reported a 56% *success* in patients with intervertebral disc herniation.[30]

However, this difference might mainly result from the defined endpoint. The results of the four high-quality studies indicate that the period of assessment is essential in view of the following efficacy pattern: no efficacy at 24 hours; some efficacy at 2 to 6 weeks; no difference or rebound worsening at 3 months and 6 months; and no difference at 1 year. Thus, the better results of the present study might be explained by the short period of assessment. The immediate post-injection amelioration of leg pain may have been due to the local anesthetic mixed with the steroid. Furthermore, *effective therapy* was defined as an improvement of two or more points on the pain intensity scale. In the present study where *effective therapy* was defined as subjective patient satisfaction, the mean improvements meet this definition. Thus, in group 1, an improvement was observed from 7.0 to 2.5 on the VRNS, in group 2 from 6.5 to 2.0, and in group 3 from 6.0 to 2.0.

Therefore, our results are in line with other studies that used a 2-point absolute change (or a 33% relative change) as optimal value for a clinically meaningful change on a 0-to-10 pain intensity scale.[31] However, the present study has obvious limitations. The first is the short pain improvement interval. However, it is well known that epidural injections are particularly helpful for pain control within the first weeks after injection.[32] Therefore the period of assessment we used allows to examine the short-term outcomes in terms of pain relief and surgical rate.

Second, due to the retrospective study design, we needed complete and accurate patient medical charts to evaluate the patients' condition. However, although data collection was performed in a routine setting by trained personal of the orthopedic center, we could not ensure the completeness of our data with absolute certainty. Third, the study was conducted at a single designated orthopedic center without randomization, making comparison of the different groups difficult. Fourth, in patients with facet joint arthrosis infiltration of the affected articulation was performed alternating to epidural infiltrations, too. Therefore, the isolated effect of epidural infiltration could not be detected in those patients. Finally, different physicians with different degree of experience performed the procedures. Therefore, the study should be considered as initial attempt to show the effects of interlaminar single-shot epidural injections. Especially with regard to effectiveness compared to the transforaminal approach, further investigations are needed.

Conclusions

In conclusion, our results demonstrate sufficient short-term pain improvement and significant reduction of pain medication in patients who were treated with an interlaminar epidural steroid injection. The results seem to be better in younger patients, but the difference was not statistically significant.

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