How reliable is lumbar nerve root sheath infiltration?


1 Orthopädische Klinik, Westfälische Wilhelms-Universität, Münster, Germany
2 Entwicklungs- und Forschungszentrum für Mikrotherapie, Bochum, Germany
3 Institut für Diagnostische und Interventionelle Radiologie der Universität Witten/Herdecke, Germany

Summary. To determine the reliability of lumbar nerve root sheath infiltration, a prospective study was performed. Ninety-four patients were randomized into three groups. In the first group of 33 patients, 0.5 cc of dye (Telebrix N, 30 g) was applied at nerve root L4, in the second group of 30 patients, 1.0 cc, and in the third group of 31 patients, 2.0 cc. The infiltration was guided by computer tomography. The diffusion of the dye was documented with computed tomography of the affected segment L4–5. The images were evaluated by an unbiased observer. The results showed that in the first group the dye diffused to the adjacent ipsilateral nerve roots L3 and/or L5 in nine patients. In the second and third groups this diffusion was seen in 9 and 11 patients, respectively. A diffusion into the psoas muscle was documented in 4, 10 and 22 patients, respectively. These latter differences were statistically significant (P < 0.01). Diffusion into the psoas muscle is especially important because the nerve roots converge in this muscle to become a plexus, and they are no longer surrounded by their dural sheaths. Diagnostic lumbar nerve root sheath infiltration should be performed by an experienced examiner. To guarantee high reliability, the tip of the needle should be placed as near as possible to the affected nerve root. The amount of local anaesthetic should be as small as possible, 0.5 cc or preferably less.

Key words: Lumbar nerve root sheath infiltration – CT-guided infiltration

In 1985 Castro and Van Akkerveeken [1] discussed the diagnostic value of selective lumbar nerve root sheath infiltration for the first time. In addition, indications for the use of this diagnostic procedure were defined [2]. However, until now, there have been no data about the reliability of this technique. The aim of this study was to assess the reliability in vivo by measuring the diffusion of dye to the adjacent lumbar nerve roots after injecting different amounts around nerve root L4.

Materials and methods

Ninety-four patients with low-back and leg pain, in whom a lumbar nerve root sheath infiltration of L4 was indicated, agreed to participate in this prospective study. Before local anaesthetic (Scandicain 1.0%) was applied, water-soluble dye (Telebrix N, 30 g) was injected under computed tomography (CT) control as near as possible to nerve root L4 (Fig. 1).

Patients were randomized into three groups. In group A (33 patients), 0.5 cc of dye was injected, in group B (30 patients), 1.0 cc and in group C (31 patients), 2.0 cc.

The diffusion of the dye was documented using a CT scanner (somatom DRG, Siemens). Transverse sections of 8 mm thickness were made of the affected segment L4–5 and the adjacent segments. To reduce artefacts as much as possible, the dye was diluted with saline 1:1. Afterwards, the above-mentioned three quantities of dye were injected. The images were evaluated by an unbiased radiologist, with particular attention being paid to the diffusion of the dye to the adjacent, ipsilateral caudal and cranial nerve roots. An analysis of the relation between the distance of the needle tip to nerve root L4 and diffusion was also carried out.

For statistical analysis a Wilcoxon test was performed at the 5% level.

Results

The overall mean distance between the tip of the needle and nerve root L4 was nearly 3.0 mm (from 0 to 5.0 mm).

In group A the distance of the tip of the needle to nerve root L4 ranged in almost all cases between 0 and 3.0 mm. Only in one patient was the distance 4.0 mm and in one, 5.0 mm. In all cases the dye was distributed around the nerve root (Fig. 1). An epidural distribution of the dye was seen in 16 of 33 patients. In intraspinal diffusion of dye to the adjacent caudal nerve root L5 was documented twice, and a diffusion to the nearest cranial nerve root L3 in six
patients (Table 1). In one case the dye diffused to the adjacent cranial as well as the caudal nerve root. A distribution of the dye to the contralateral side was documented twice. A diffusion to the adjacent caudal nerve root L5 in the psoas muscle was only seen in four cases (Table 1).

In group B the distance of the tip of the needle to nerve root L4 ranged, except for one patient (5.0 mm), between 0 and 4.0 mm. In all cases the dye distributed around the nerve root. An epidural distribution was seen in 20 of 30 patients (Fig. 2). An intraspinal diffusion to the adjacent caudal nerve root L5 was documented in five patients; a diffusion to the adjacent cranial nerve root L3 in three (Fig. 2). Once the dye spread to the nearest caudal as well as to the nearest cranial nerve root. A diffusion to the contralateral side was also seen once. A diffusion in the psoas muscle to the nearest caudal nerve root L5 was seen in 9 patients (Fig. 2) and to the nearest cranial nerve root L3, once.

In group C the distance of the tip of the needle to nerve root L4 ranged from 1.0 to 2.0 mm. In all cases the dye distributed around the nerve root. An epidural distribution was seen in 23 of 31 patients. An intraspinal diffusion to the adjacent caudal nerve root L5 was documented in three patients, and diffusion to the nearest cranial nerve root L3 in seven (Table 1). In one case the dye diffused to the adjacent cranial as well as caudal nerve root. A distribution of the dye to the contralateral side was documented once. A diffusion in the psoas muscle to the adjacent caudal nerve root L5 was seen in 20 cases and once to the nearest cranial as well as nearest caudal nerve root (Table 1).

No statistically significant differences could be found between the three groups for intraspinal diffusion of the dye. However, the variations between them for diffusion in the psoas muscle were statistically significant ($P < 0.01$).

Analysis of the relationship between the distance of the needle tip to the affected nerve root and diffusion showed that there was no significant difference between the two parameters.

### Discussion

In order to assess whether the complaints of patients with low-back and/or leg pain are caused by changes visualizable by imaging modalities, NacNab [4] introduced selective lumbar nerve root sheath infiltration. In patients with multilevel changes on imaging modalities and signs of nerve root entrapment, nerve root sheath infiltration can be crucial for their subsequent treatment [2]. However, high reliability is obligatory. According to Castro and Van Akkerveeken [2], the amount of local anaesthetic should be as small as possible. No study dealing with the quantity of local anaesthetic was found in the literature.

This study for the first time showed that the amount should be as small as possible, 0.5 cc or less. Even in the group of patients in whom only 0.5 cc of dye was injected, an intraspinal diffusion of dye to the nearest ipsilateral caudal (L5) and cranial (L3) nerve roots was documented.

### Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>0.5 cc (n = 33)</th>
<th>1.0 cc (n = 30)</th>
<th>2.0 cc (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS/PM</td>
<td>IS/PM</td>
<td>IS/PM</td>
<td>IS/PM</td>
</tr>
<tr>
<td>Caudal nerve root</td>
<td>2/4</td>
<td>5/9</td>
<td>3/20</td>
</tr>
<tr>
<td>Cranial nerve root</td>
<td>6/0</td>
<td>3/1</td>
<td>7/1</td>
</tr>
<tr>
<td>Cranial and caudal nerve root</td>
<td>1/0</td>
<td>1/0</td>
<td>1/1</td>
</tr>
</tbody>
</table>

Fig. 1A, B. Distribution of 0.5 cc of dye around the affected nerve root: (a) position of the needle before injection, (b) after injection

Fig. 2. Distribution of 1.0 cc of dye around the affected nerve root (A, B), in the epidural space with diffusion to the adjacent cranial nerve root (C, D), as well as to the adjacent caudal nerve root in the psoas muscle (E)