

# Lumbar Discography: Should We Use Prophylactic Antibiotics?

## *A Study of 435 Consecutive Discograms and a Systematic Review of the Literature*

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**Background:** Lumbar discography can be used in the diagnostic work-up of degenerative spine disease. The most serious complication is discitis, believed to be due to penetration of the disc by a needle contaminated with skin flora. The use of prophylactic antibiotics has been advocated, although there is great concern regarding their efficacy and possible adverse effects on disc cells.

**Methods:** In the current study, the incidence of postdiscography discitis without the use of prophylactic antibiotics was studied in a consecutive patient group. Additionally, a systematic literature review was performed using strict criteria: 1) Discography was performed by means of a two-needle technique, 2) complications such as discitis were specifically looked for at follow-up, and 3) the exact numbers of patients and those lost to follow-up were reported.

**Results:** The clinical results of 200 patients with 100% follow-up for a minimum period of 3 months showed no case of discitis. In the literature review, 10 studies were selected. Nine studies without prophylactic antibiotics reported an overall incidence of 12 cases in 4891 patients (0.25%) or 12,770 discs (0.094%). The only study with prophylactic antibiotics (127 patients) showed no case of discitis.

**Conclusions:** Regarding the small number of patients in the only study in which antibiotics were used and the overall low incidence of postdiscography discitis, not enough evidence was found that prophylactic antibiotics can prevent discitis. It was concluded that in lumbar discography by means of a two-needle technique without prophylactic antibiotics, the risk of postdiscography discitis is minimal and there is not enough support from the literature to justify the routine use of prophylactic antibiotics.

**Key Words:** lumbar discography, discitis, antibiotic prophylaxis

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As part of the diagnostic work-up in the evaluation of degenerative spine disease, lumbar discography can be performed in case the clinical problem may require surgical treatment.<sup>1,2</sup> Next to visualizing the internal structure of the disc, the benefit of discography is its ability to distinguish between symptomatic and asymptomatic degenerative discs. In this way, when planning an arthrodesis of the spine, the number of motion segments to be fused can be determined.

Discography is an invasive procedure with a fairly low complication rate.<sup>3–5</sup> The most serious complication is discitis, believed to be due to penetration of bacteria into the disc by a needle contaminated with skin flora.<sup>6</sup> Although very few authors seem to have specifically checked for postdiscography discitis at follow-up, generally low incidences have been reported.<sup>3</sup> As discitis is a serious complication for a diagnostic procedure, prevention by the use of prophylactic antibiotics, either intravenously or intradiscally, has been advocated.<sup>7</sup> There is, however, controversy concerning the ability of intravenous antibiotics to penetrate the disc and reach a therapeutic level.<sup>8,9</sup> Furthermore, little is known about possible side effects of the use of intradiscal antibiotics. As damaging effects on disc tissue have already been reported,<sup>10</sup> caution regarding the use of prophylactic antibiotics is warranted.

In search for a clinical guideline in lumbar discography, the aims of the current study were 1) to determine clinically postdiscography discitis incidence in a consecutive group of patients without the use of prophylactic antibiotics and 2) to perform a systematic literature review to study postdiscography discitis incidence in general.

### MATERIALS AND METHODS

During 1 year, the records of all consecutive patients undergoing lumbar discography as part of the work-up for degenerative lumbar spine disease were investigated. All procedures were carried out in the Radiology Department by orthopaedic residents affiliated with the spine unit. No standard preoperative sedation was used, and no prophylactic antibiotics were

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administered. According to the technique described by McCulloch and Waddell,<sup>3</sup> the patients were placed in the left lateral decubitus position. The skin was prepared with Betadine and draped in a routine manner. An image intensifier was used to provide both lateral and anteroposterior views of the spine. After superficial infiltration of local anesthetic, a solid stilette double needle (18-gauge outer and 22-gauge inner solid needle) was advanced to the intended disc space. After fluoroscopic confirmation that the needle was in the center of the disc, the inner solid needle was removed, and Isovist, a water-soluble, nonionic contrast dye (Schering AG, Berlin, Germany), was injected slowly. If the disc center could not be approached properly, an open, more flexible 22-gauge needle was advanced through the outer needle to reach the center. Volume and pressure of the dye injected as well as its distribution pattern in the disc were scored according to the criteria of Adams et al,<sup>11</sup> and the patient's response was registered. For each disc level, separate needles were used. One hour after the procedure, patients were sent home with the instruction to return immediately in case of aggravated back pain or fever. Routine control followed at 6–12 weeks after discography. In case of pain, discomfort, or fever, laboratory and radiologic controls were performed. Discitis was diagnosed when erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were raised and magnetic resonance imaging (MRI) revealed the typical increased bony signal in the vertebral bodies with destruction of the endplates and paravertebral signal enhancement.<sup>12</sup> In those cases where the records did not reveal the

postdiscography status or follow-up had been <12 weeks, patients were approached for a telephone interview and questioned for the above-mentioned symptoms during the first 3 months after the procedure.

### Literature Search Strategy and Selection Criteria

To obtain all relevant literature, the most common databases of published literature were used:

*Medline* (1966 to January 2003)

*Current Contents* (1996 to February 2003)

*Cochrane database of randomized controlled trials* (2003, issue 1)

The search strings with the number of matches for each string are shown in Table 1. No restrictions were made on language or date. On the basis of the abstracts, articles were selected by two independent reviewers. The references from the selected articles were checked in the same way to ensure no relevant articles were missed.

Articles were finally included when they met the criteria in the following checklist:

Lumbar discography should be performed at all levels with an adequately described two-needle technique under strict aseptic conditions.

The presence of complications such as postdiscography discitis must have been specifically looked for at follow-up and should be noted as such.

**TABLE 1.** Number of Articles Found with Search Strings and Databases Used

Search Strings	Database		
	Medline	Current Contents	Cochrane
Diagnosis			
Discitis (mesh)	690	101	3
Discitis (tw)	875	170	9
Infection (tw)	403,443	183,636	17,246
Postoperative complications (mesh)	244,608	893	13,919
Complications (tw)	1,288,535	82,472	37,381
Union diagnoses	1,625,657	256,529	54,355
Treatment			
Intervertebral disc/radiography* (mesh)	1182	357	60
Discography (tw)	439	597	18
Union treatment	1390	935	73
Indication			
Lumbar (tw)	44,472	14,341	2615
Lumbar vertebrae (mesh)	19,572	132	647
Union study design	44,472	14,341	2615
Intersection	219	36	24
Intersection databases			263

The exact number of patients and those lost to follow-up should be noted.

Preferably a minimum follow-up of 3 months was used. If both reviewers could not reach consensus, a third reviewer was consulted.

## RESULTS

Discography was performed in exactly 200 patients (88 men, 112 women) with a mean age of 41 (16–62) years. Forty patients had discography at one level, 85 patients at two levels, and in 75 patients three levels were involved. Thus, in total 435 discs were injected. Three patients had reported signs of discomfort or fever at follow-up visit. Laboratory controls, however, showed no significant elevation of ESR or CRP and their MRI scan was negative for discitis. As their symptoms resolved spontaneously, discitis was excluded. As all patients could be reached by phone, 100% follow-up was guaranteed. No patient reported complaints of fever or discomfort regarding his or her back in the first 3 months after discography, and thus an overall incidence of 0% postdiscography discitis was registered.

## Literature Search

The search yielded 263 references, of which 217 papers were excluded on the basis of an abstract and title that showed no relation to the human lumbar spine in vivo and discography. The remaining 46 papers were subjected to a thorough investigation with the aid of the above-mentioned criteria. Additionally, the references were screened according to the same rules to make sure that no relevant articles were missed. Finally, 10 papers,<sup>4,6,7,13–19</sup> spanning a period of 40 years, were selected and listed in Table 2. Two of these studies<sup>7,19</sup> actually reported a minimum follow-up of 3 months, whereas the remaining

studies did not specify the exact term of follow-up. In only one of the selected studies had prophylactic antibiotics been used, and a postdiscography discitis incidence of 0% was found.<sup>7</sup> In the other nine studies, no prophylactic antibiotics had been administered. These studies revealed 12 cases of discitis in 4891 patients and 12,770 discs with an incidence of 0.25% by patient and 0.094% by disc. Three of these studies,<sup>14,17,19</sup> as well as the current study, reported no case of discitis.

Combining the literature results with the current patient study leads to an overall incidence of 0.24% by patient and 0.091% by disc.

## DISCUSSION

Discitis after discography has been recognized as a distinct entity that is considered to be due to bacterial infection<sup>6,20</sup> and should not be confused with the common exacerbation of backache after intradiscal injection most probably due to a mechanical or chemical cause. The most common causative agents are considered to be *Staphylococcus aureus* and *S. epidermidis*, although the incidence of gram-negative bacteria appears to be rising.<sup>10,21,22</sup> Fraser et al<sup>6</sup> isolated bacteria from the disc in three of four discitis patients who had open biopsy <6 weeks after discography, and they suggested bacteria introduced by the needle tip to be the initiators of the disease. To eliminate the risk of injecting a core of soft tissue including skin, the use of stilette needles and a two-needle technique was recommended, with which the incidence of discitis could be reduced from 2.7% to 0.7%. In a prospective clinical trial of 127 patients undergoing lumbar discography with cephazolin added to the contrast dye, Osti et al<sup>7</sup> reported no case of discitis and recommended the use of a single dose of prophylactic broad-spectrum antibiotic either added to the radiographic contrast material or administered intravenously. However,

**TABLE 2.** Discitis Incidences in Selected Literature and Current Study by Patient and by Disc

Study	Year	Prophylactic Antibiotics	No. of Patients	No. of Discs	Discitis Cases	Incidence by Patient (%)	Incidence by Disc (%)
Collis and Gardner <sup>13</sup>	1962	No	1014	2187	1	0.10	0.05
Patrick <sup>14</sup>	1973	No	123	341	0	0.00	0.00
Colquhoun <sup>15</sup>	1977	No	716	2000	1	0.14	0.05
Milette and Melanson <sup>16</sup>	1982	No	500	1009	3	0.60	0.30
Fraser et al <sup>6</sup>	1987	No	210	417	4	1.90	0.98
Guyer et al <sup>4</sup>	1988	No	2014	6042	2	0.10	0.05
Jackson et al <sup>17</sup>	1989	No	124	231	0	0.00	0.00
Simmons et al <sup>18</sup>	1991	No	164	465	1	0.61	0.22
Carragee et al <sup>19</sup>	2000	No	26	78	0	0.00	0.00
Current study	2003	No	200	435	0	0.00	0.00
Literature combined with current study	—	No	5091	13,205	12	0.24	0.09
Osti et al <sup>7</sup>	1990	Yes	127	337	0	0.00	0.00

Eismont et al<sup>23</sup> reported no detectable levels in discs of rabbits after intravenous administration of either cephalothin or oxacillin, and Gibson et al<sup>8</sup> was unable to retrieve any cephradine or flucloxacillin from human intervertebral discs intraoperatively in 25 scoliosis patients. Boscardin et al<sup>9</sup> found therapeutic levels in only a short period after intravenous administration of high doses of cefazolin, whereas Rhoten et al<sup>24</sup> found quantifiable levels of cefazolin and oxacillin in only 40% of human cervical discs. As the disc is an avascular structure with blood vessels found only at its margins,<sup>25</sup> intradiscal nutrition and levels of permeation of drugs depend on passive diffusion through the adjacent endplates and the surrounding annulus fibrosis. The disc has a negatively charged structure, which implies that positively charged antibiotics such as gentamicin may diffuse more rapidly and be more effective than the negatively charged antibiotics such as cephalosporins.<sup>26</sup> In a prospective study of 20 patients undergoing spinal surgery, Tai et al<sup>21</sup> could detect no therapeutic level of cefuroxime in the disc, whereas gentamicin showed a 50% penetration from blood to disc, well within the therapeutic range. They suggested, in accordance with Rhoten et al<sup>24</sup> and Langmayr et al,<sup>27</sup> that high doses of cephalosporins are required to achieve therapeutic levels in the disc. Important in this respect are the recent findings by Hoelscher et al<sup>10</sup> that high doses of antibiotics, including both cephalosporins and aminoglycosides, can have deleterious effects on the survival of cultured disc cells, cell proliferation, and metabolic rates. This may have serious implications if antibiotics are to be mixed with contrast dye and injected directly into the disc, creating local peak concentrations. Moreover, side effects of aminoglycosides are well known, and sensitization or anaphylactic reactions should always be anticipated.<sup>28</sup>

In the current study, lumbar discography was performed in 200 consecutive patients by means of a stilette two-needle technique under strict aseptic conditions without the use of prophylactic antibiotics. A discitis incidence of 0% was found. As method of study, the routine postclinical assessment was used, which we consider crucial in the detection of postdiscography discitis. It has been stated that underestimation of discitis incidence is possible because of the latent period between discography and the onset of symptoms, lack of clinical contact between patient and clinician, and lack of awareness by the clinician.<sup>6,29</sup> Therefore, a routine follow-up visit is mandatory. As the onset of symptoms of discitis after uneventful discography normally develops within a few weeks and at least within 10–12 weeks,<sup>29,30</sup> we believe no case of discitis has gone undetected by our method.

In a review of 15 studies, the North American Spine Society<sup>5</sup> calculated an overall incidence of <0.15% by patient and <0.08% by disc. Not all of these studies reported the exact number of patients and those lost to follow-up, and no distinction was made between studies using a one- or a two-needle technique. In the current literature search, without the use of

prophylactic antibiotics, overall incidences of 0.25% by patient and 0.094% by disc were found (see Table 2). In one of these selected papers,<sup>6</sup> unusually high incidences (1.90% and 0.98%, respectively) in 210 patients were reported. This might have been caused by the fact that in 61 of these patients, discography was performed by less experienced physicians, leading to 3 cases of discitis (4.9%), as opposed to 1 case in 149 patients (0.7%) if the procedure had been carried out by an experienced discographer. In the current literature search, only one study of lumbar discography with the use of prophylactic antibiotics, in which discitis was specifically looked for, was selected.<sup>7</sup> In this series of 127 patients (337 discs), no case of discitis was registered. However, to prove that additive antibiotics actually prevent postdiscography discitis, given the incidence of 0.25% by patient, a randomized trial of approximately 9000 patients would be needed to reach significance (calculated sample size for dichotomous response variables). Taking into account the possible adverse effects of antibiotics, we feel there is not enough evidence to regard the routine use of prophylactic antibiotics indicated in lumbar discography. At present, as has been stressed before,<sup>31</sup> it is considered imperative that discography be carried out by a physician who is very experienced with the procedure, performs it on a routine basis, and is meticulous with the two-needle technique and aseptic conditions.

## CONCLUSIONS

This study has shown that lumbar discography performed with a stilette two-needle technique without prophylactic antibiotics can be a safe procedure with a minimal risk of development of discitis. As there is no evidence in the literature that prophylactic antibiotics actually reduce the incidence of discitis, we feel that the routine use of prophylactic antibiotics in lumbar discography is not indicated.

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