

## Association Between Sciatica and Microbial Infection: True Infection or Culture Contamination?

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**Study Design.** Discs were cultured during discectomy from patients with back pain, sciatica, and radiologic evidence of disc herniation causing nerve root compression.

**Objective.** To investigate the claim of culpability of bacteria in causing the local inflammatory process seen in patients with disc herniation and radiculopathy.

**Summary of Background Data.** Bacteria have been cultured from intervertebral discs of patients with sciatica. An infectious etiology for sciatica could have a dramatic effect on treatment options for this common problem.

**Methods.** To minimize the risk of contamination, the surgeon performed processing and culturing procedures intraoperatively under stringent sterile conditions. Immediately following disc excision, the specimens were divided into 4 pieces, and cultured in various aerobic and anaerobic culture mediums that were incubated for 2 weeks.

**Results.** The 120 specimens from 30 patients underwent bacterial culture growth: 116 were sterile, an 4 aerobic cultures (2 patients) grew coagulase-negative staphylococci, suggestive of contamination.

**Conclusions.** These results refute the hypothesis that microbial infection plays a role in the pathogenesis of sciatica. It is possible that bacterial growth from discs reported in previous studies was at least partly related to contamination, which we painstakingly avoided by application of rigorous aseptic techniques.

**Key words:** sciatica, disc inflammation, microbial infection, low back pain. **Spine 2006;31:2507–2509**

Low back pain and sciatica associated with intervertebral disc herniation is extremely common.<sup>1–5</sup> Intervertebral disc herniation with protrusion of nucleus pulposus material is associated with a local spinal nerve root inflammatory process.<sup>6–8</sup> This inflammatory process is associated with the local release of pro-inflammatory cytokines and pain mediators,<sup>9–12</sup> which may explain the pain associated with disc herniation.

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Stirling *et al*<sup>13</sup> recently proposed a heretofore unexplored possibility that one of the causes of this inflammation may be an infectious process caused by low virulent microorganisms. They cultured surgically excised intervertebral disc specimens from patients with sciatica and identified *Propionibacterium acnes* (*P. acnes*) in 19 of 36 (53%) samples. If this finding could be validated, it would represent a dramatic turnabout in the therapeutic rationale of lower back pain with sciatica.

A careful analysis of the methodology of Stirling *et al*<sup>13</sup> raised a few doubts about the validity of their findings. Although long-term incubation may reveal infection caused by low virulence microorganisms that may otherwise be unrecognized, this approach also has a risk of culture contamination, especially by bacteria that are normally skin saprophytes, such as *P. acnes*. To investigate the hypothesis that sciatica is associated with *P. acnes* infection, we designed the current study in a way that would obviate the risk of specimen contamination by placing cultured intervertebral disc material directly onto culture plates during surgery in the operating theater, and not in the microbiologic laboratory, and by using stringent aseptic techniques.

### ■ Methods

**Setting and Participants.** A total of 30 consecutive adults scheduled for surgical lumbar disc excision as a result of severe back pain and sciatica were recruited. They all had clinical evidence of sciatica and disc herniation causing nerve root compression shown by computerized tomography and/or magnetic resonance imaging. The 30 study participants included 12 females and 18 males, with a mean age of 46.4 years (range 27–77).

There were 15 patients who had neurologic motor weakness of the affected leg; the other 15 had either intractable pain with or without neurologic sensory symptoms, or reduced knee jerk or Achilles reflexes. The L4–L5 intervertebral disc was excised in 16 patients, L5–S1 in 12, and L3–L4 in 2. Disc herniation types included disc protrusion in 10 patients, disc extrusion in 14, and disc sequestration in 6. Acneform skin lesions were noted on the backs of 2 patients, but not directly over the surgical incision site.

The surgical procedure included discectomy in all patients. Antibiotic standard surgical prophylactic treatment with cefazolin was not deprived of these patients. We reasoned that cefazolin would not affect the study results because it does not penetrate into the disc.<sup>14</sup>

There were 12 patients who underwent spinal fusion procedures in conjunction to discectomy. These procedures included 9 transforaminal lumbar interbody fusions with bilateral pedicle screw fixation and bilateral posterolateral fusion, 2 patients

underwent pedicle screw fixation and bilateral posterolateral fusion without lumbar interbody fusion, and in 1 patient, a posterior dynamic motion sparing device (Wallis) was inserted between the spinous processes. Individuals who had been treated with antibiotics in the 2 months preceding the study, and those who had undergone prior back surgery and/or with a history of intradiscal injections (e.g., diskography, and intradiscal electrothermal therapy) were excluded. All suitable patients were familiarized with the nature of this investigation and signed an informed consent form as approved by the institutional review board.

**Study Design.** To minimize the risk of contamination, the surgeon performed all processing and culturing procedures intraoperatively, and under stringent, sterile, operating theater conditions. We used multiple culture mediums for each intervertebral disc: 2 trypticase soy agar plates with 5% defibrinated sheep blood (Hylabs Ltd., Rehovot, Israel); 1 chocolate agar plate (Hylabs Ltd.); and 1 test tube containing liquid thioglycolate medium (Hylabs Ltd).

Culture mediums were warmed to room temperature before each operation. A meticulously sterile surgical technique was used to perform surgery. During surgery, immediately following intervertebral disc removal, the surgeon dissected the disc material into 4 approximately equal pieces. There were 3 pieces sterilely smeared onto 2 blood agar plates and 1 chocolate agar plate, and then embedded into the agar. The fourth piece was placed in a tube containing thioglycolate liquid medium. One of the blood agar plates and the thioglycolate tube were placed in an anaerobic sterile pouch (Pouch bag; Hylabs Ltd.) with an oxygen-absorbing carbon dioxide-generating foil bag (Mitsubishi Gas Chemical Co., Inc.), while the other agar plates were kept under aerobic conditions. Specimen processing and culturing were completed within minutes of the intervertebral disc excision. The cultured specimens were then immediately transferred to the microbiology laboratory, where they were incubated at 37°C for 2 weeks. A *P. acnes* isolate was cultured under the same conditions and by using the same culture media, and it served as a control. Culture mediums were incubated 2 weeks and assessed for bacterial growth.

## ■ Results

Of the 120 cultures from 30 specimens, 116 showed no signs of microbial growth whatsoever. Four aerobic cultures from 2 patients grew coagulase-negative staphylococci suggestive of contamination.

## ■ Discussion

An infectious etiology for the local inflammatory process associated with sciatica would have a dramatic effect on treatment options for this common problem, but there is very little evidence in the literature to support this hypothesis. Lumbar intervertebral disc herniation causing low back pain and sciatica is associated with a local inflammatory process.<sup>6,7,12</sup> This inflammatory process has been associated with macrophage recruitment and infiltration, and secretion of pro-inflammatory cytokines, which in turn may correlate with pain and neurologic symptoms.<sup>8,9</sup> Interestingly, nerve and other tissues produce an inflammatory reaction when exposed to viable nucleus pulposus cells.<sup>6-8,15</sup> The fact that exposure

to viable nucleus pulposus cells causes an inflammatory reaction similar to that seen in infections does not necessarily imply that this inflammation is infectious in origin. Rather, this could be a direct biochemical inflammatory reaction caused by the inflammatorogenic properties of the nucleus pulposus itself.<sup>6-8,15</sup> Furthermore, nucleus pulposus cells have secreted pro-inflammatory cytokines such as interleukin 1, 6, and 10, and granulocyte-macrophage colony stimulating factor,<sup>9</sup> and have induced macrophage recruitment.<sup>8,15</sup>

Pain mediators, such as substance P and tumor necrosis factor- $\alpha$ , have also been released or activated when nerve tissue comes in contact with nucleus pulposus material.<sup>10,11</sup> Moreover, the inflammatory process and pro-inflammatory cytokine production is up-regulated by the interaction of nucleus pulposus cells and macrophages.<sup>16</sup> The process that precedes the inflammation and initiates disc herniation may be one of a mechanical-degenerative nature.<sup>17</sup>

Clinical reports connecting infection and sciatica with disc herniation are scarce. Dupeyron *et al*<sup>18</sup> reported 4 cases of sciatica with same-level disc herniation and a final diagnosis of acute radiculitis caused by *Borrelia burgdorferi*. Their patients had a favorable response to antibiotic therapy. They concluded that both disc herniation and neurologic manifestations of Lyme disease (radiculitis) might coexist as separate unassociated entities. Karppinen *et al*<sup>19</sup> suggested an increased risk of lumbar segmental artery occlusion in patients with sciatica and chronic Chlamydia pneumonia infection, but their patients were also more likely to be smokers and obese than patients without evidence of infection. To our knowledge, Stirling *et al*<sup>13</sup> were the first to suggest that the inflammation associated with sciatica may be caused by an indolent bacterial infection. Their findings of  $\geq 50\%$  positive cultures from intervertebral discs (84% of them for the same bacteria *P. acnes*) would suggest that an even higher percentage of infected discs would be identified by more sensitive methods, such as the detection of deoxyribonucleic acid using polymerase chain reaction. When Fritzell *et al*<sup>20</sup> used polymerase chain reaction, they detected bacterial deoxyribonucleic acid in only 3 of 18 disc samples. Nevertheless, they hypothesized that an infectious etiology for disc herniation may cause symptoms of back pain and sciatica.

Because all the bacteria that had been cultured from discs in the aforementioned studies are normal skin saprophytes, and considering that the more sensitive the study protocol was, the fewer bacteria were found, it is reasonable to speculate that culture contamination may play a major role in these findings. Indeed, Cosica *et al*<sup>21</sup> found a 44% positive disc culture rate from patients undergoing surgical disc excision, but after reviewing their results, suspected them as probable culture contamination (written communication).

We planned the current study with the understanding that culture contamination caused by normal skin saprophytes must be differentiated from true disc infection.

Our protocol was designed to minimize the risk of contamination. We originally set out to validate the hypothesis suggested by Stirling<sup>13</sup> and Cosica<sup>21</sup> *et al* and, therefore, adopted their strategy of not changing standard surgical care protocols, including the use of prophylactic antibiotics (cefazolin), thus ensuring patient safety while conducting research. We reasoned that cephalosporin prophylactic antibiotics would not affect the research results because these antibiotics do not penetrate into the intervertebral discs.<sup>14</sup>

We found no evidence of *P. acnes* growth in any of the 120 cultures from 30 specimens, while 4 aerobic cultures from 2 patients grew coagulase-negative staphylococci that were suggestive of contamination. Thus, the results of this study could not support the hypothesis that infections by Propionibacterium or other bacteria play a role in the pathogenesis of intervertebral disc herniation and sciatica. It is possible that the bacterial growth from discs that had been reported in previous studies were at least partly related to contamination. We conclude that the inflammatory process associated with intervertebral disc herniation and sciatica apparently does not have a bacterial infectious etiology.

#### ■ Key Points

- Bacteria have been cultured from the intervertebral discs of patients with sciatica. An infectious etiology for sciatica could have a dramatic effect on treatment options for this common problem.
- Discs were cultured during discectomy from patients with back pain, sciatica, and radiologic evidence of disc herniation causing nerve root compression.
- A meticulous aseptic technique was used in processing and culturing procedures, which the surgeon performed intraoperatively under stringent sterile conditions.
- Following 2 weeks of incubation, 116 of 120 cultures were sterile.
- These results refute the hypothesis that microbial infection plays a role in the pathogenesis of sciatica.

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