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LETTER TO THE EDITOR - SPINE - OTHER

Reply to the letter to the editor of E. Shiban and B. Meyer regarding "Endplate changes after lumbar discectomy with and without implantation of an annular closure device" by Barth M et al., (Acta Neurochir (Wien) 2018 Apr;160(4):855–862)

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Dear Editor,

We thank the authors for their interest in our original submission [3] and the subsequent letter. We had reported on the incidence and size of end plate changes (EPC) 12 months after microdiscectomy with ($n = 242$) or without ($n = 251$) implantation of an annulus closure device (ACD). EPC increased in both groups, but were significantly more pronounced after additional ACD implantation. Presence and growth of EPC, however, was not correlated with low back pain or ODI.

The authors of the letter hypothesize causality between the presence of low virulent anaerobic bacteria and EPC, which is obviously based on a single case of ACD anchor loosening they have encountered [7]. However, current evidence clearly speaks against the authors' speculations:

First, there was not a single case of implant loosening in our series of 242 patients that would resemble the authors' case report [7]. EPC should not be intermingled with aseptic implant failure or loosening, as they generally occur in the opposing endplate. A potential low virulent infection of the implant would obviously be expected to occur at the site of implantation.

Second, although we agree with the authors that low-grade infection of spinal instrumentation seems to be an underdiagnosed problem, the hypothesis of low virulent infections being responsible for a major proportion of implant failure in spine surgery still remains to be proven. Only one retrospective study is available showing preliminary evidence for a relation between positive infection screening and screw loosening [8]. In addition, *P. acnes* is a moderately aerotolerant anaerobic bacillus with a restricted survival in oxygen [11]. It has been suggested that *P. acnes* cannot stay alive in highly vascularized tissues as aerobic bone and would not be present there [13]. Biofilms on implants are therefore thought to be a prerequisite for these infections, and as mentioned above, EPC are mostly not in direct contact with the ACD implant.

Third, the data on bacterial colonization of discs is at best inconclusive. There is some evidence of low virulent germs such as *Staphylococcus epidermidis* and *Propionibacterium* in operated non-pyogenic discs [1, 2, 12, 14]. One study found positive cultures in 46% of herniated discs with 86% being infected with *P. acnes* and in addition a radiological association of Modic type 1 changes in adjacent vertebrae [2]. At least three studies [4, 9, 10], however, did not find any bacteria at all with the largest covering more than 300 intervertebral disc

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samples without original growth of *P. acnes* [4], so that contamination issues were raised.

Fourth, colonization has been described to be associated with chronic low back pain and sciatica [12] and aseptic implant failure is blamed for clinical symptoms. The clinically asymptomatic nature of EPC, however, represented one of the most striking findings of our study, which also contradicts the infection hypothesis.

Nevertheless, the authors have to be congratulated for their efforts to address aseptic implant failure and their theory that EPC may be associated with low virulent infections.

Pathophysiologically, circulating microbes may enter the disc space as a result of the neovascularization associated with disc degeneration [5]. Once inside the disc, they may produce cytokines and propionic acid resulting in local inflammation, seen as Modic changes on MRI. The number of patients with degenerated and potentially infected discs would be distributed equally between study groups, which would be in line with the comparable incidence of EPC at baseline in our study. EPC grow within the first year after surgery with or without the ACD, but occur more frequently with the implant. If the ACD would favor the local environment for low virulent germs, it must be expected that the implant itself carries a biofilm (and the bacteria) and its anchor loosens over time. This was not the case in any of our 242 patients.

We agree with the authors, that a longer follow-up is needed. Two-year results have recently been published [6] and patient follow-up in the RCT has reached 5 years for a large proportion of patients. So far, there is no indication for clinical symptoms associated with EPC or for anchor loosening (*unpublished data*).

In summary, current data from our study and the literature clearly speaks against the letter's hypothesis. EPC mostly occur in the endplate opposite to the implant and are more common if the ACD is implanted in the lower rather than the upper vertebrae. This in conjunction with the listed arguments favors the hypothesis that additional mechanical stress is responsible for an increase in EPC after ACD implantation, even though they also occur after microdiscectomy alone. Further follow-up and future literature will shed more light onto the importance of low virulent infection in spinal implant failure as well as in disc degeneration.

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