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Postoperative Spondylodiscitis: Results of a Prospective Study About the Aetiology of Spondylodiscitis After Operation for Lumbar Disc Herniation

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Summary

In 412 patients undergoing surgery for herniated lumbar discs from September 1986 to September 1987 and from January 1988 to July 1989 a microbiological specimen was taken from the intervertebral disc space and from the cover of the operating microscope. Also the tips of the wound drains were examined microbiologically after removal. 17% of the patients had a positive bacteriological culture from their intervertebral disc space; 12% of the specimen from the operating microscope were positive. These results favour the hypothesis that intra-operative contamination of the disc space, in contrast to haematogeneous spread, causes spondylodiscitis. On the other hand we saw during this time course only one case of clinical spondylodiscitis, which implies a possible involvement of other predisposing factors such as pre- or perioperative infections or compromised patient immunologically. It is also possible, that the routine application of local antibiotic or antiseptic solutions into the disc space at the end of the operation could decontaminate the operative site and prevent clinical infection despite positive culture findings.

Keywords: Spondylodiscitis; lumbar disc operation; intraoperative contamination.

Introduction

Postoperative spondylodiscitis is a rare, but severe complication of lumbar discectomy. The incidence varies among different authors from 0.1–3.0%[3, 6, 12, 15, 20, 21, 22]. The incidence of all types of postoperative infectious complications varies from 0–18.8%[8, 12, 26]. Haematogeneous dissemination for spontaneous spondylodiscitis is well established in children[7, 10, 26]. However, there is debate, whether spondylodiscitis in adults is due to intra-operative contamination of the disc space or due to haematogeneous spread from other organ systems.

The study, which is presented in this paper, tries to elucidate the possible role of intra-operative contamination.

Material and Methods

In 412 patients operated on for herniated lumbar disc between September 1986 and September 1987 and between January 1988 and July 1989 a microbiological specimen was taken at the end of the operation from the empty intervertebral disc space. Between January 1988 and July 1989 a specimen was also taken from the cover of the operating microscope. Additionally we examined the tip of the wound drain, which was generally removed the day after operation, for bacteriological cultures. The distribution of the age and the level of operation is shown in Table 1 and Fig. 1.

The operations were performed by different neurosurgeons using the standard microsurgical technique. After excision of the ligamentum flavum (flavectomy) or after a hemilaminectomy the nucleus pulposus was removed as complete as possible, although care was taken not to damage the vertebral endplates with instruments. Before finishing the operation a specimen was taken from the depth of the intervertebral disc space with a Cushing cannula. The specimen from

Table 1. *Distribution of Site of Operation*

Level	Number
L 2/3	2
L 3/4	24
L 4/5	179
L 5/S 1	199

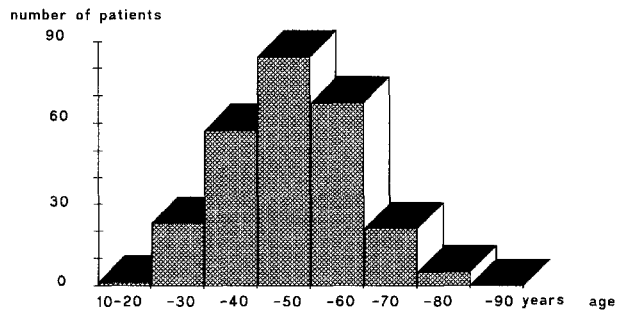

Fig. 1. Age distribution of the group

the operating microscope was taken from the covering of the lens with a cotton tip. Then the disc space was filled with several cc of a Betadine (Polyvidon-iodine) solution or a topical antibiotic (neomycin sulphate). The specimen and the tips of the wound drainage were sent immediately for microbiological investigation.

Results

In 70 patients (= 17%), a positive bacteriological result was obtained from the disc space. Table 2 shows the different organisms. In 29 cases (= 12%) an organism grew in the culture obtained from the covering of the operating microscope (Table 3). Of the 380 wound drainage tips in 35 cases a positive result was received (= 9%) (Table 4). In 16 patients a positive culture was obtained from the operating microscope while the disc space was sterile. On the other hand in 13 cases the cultures from disc space were positive while those from the operating microscope were negative. In 7 cases a positive culture result was obtained from the disc space and the microscope. In 5 of 7 cases the organisms were identical: in three cases staphylococcus aureus, in one case enterococcus faecalis and in one case Escherichia coli. The other two cases showed staphylococcus epidermidis from the disc space and alpha-haemolytic streptococci and enterococcus faecalis from the operating microscope.

Table 2. *Pathogenic Agents in the Intervertebral Space*

Pathogenic agents	Number
Staphylococcus aureus	13
Staphylococcus epidermidis	16
Staph. epidermidis and staph. saprophyticus	1
Staphylococcus saprophyticus	2
Staphylococcus capitis	2
Staphylococcus warneri	1
Coagulase negative staphylococci	1
Staphylococcus aureus and streptococcus faecalis	4
Streptococcus faecalis	6
Alpha-haemolytic streptococci	3
Streptococcus viridans	2
Streptococci group D	1
E. coli	4
Acinetobacter Iwolfii	1
Propioni bacterium acnis	1
Spore-forming organisms	5
Klebsiella pneumoniae	2
Flora of skin	2
Providencia stuartii	1
Enterobacter cloacae	1
Candida albicans	1

Table 3. *Pathogenic Agents on the Microscope (January 88 to July 89)*

Pathogenic agent	Number
Staphylococcus aureus	6
Staphylococcus epidermidis	2
Staphylococcus saprophyticus	1
Coagulase negative staphylococci	7
Apathogen staphylococci	2
Alpha-haemolytic streptococci	2
Micrococcus	1
E. coli	1
Klebsiella oxytoca	1
Enterococcus faecalis	5
Enterobacter aerogenes	1

Table 4. *Pathogenic Agents on the Wound Drainage (January 89 to July 89)*

Pathogenic agent	Number
Staphylococcus aureus	1
Staphylococcus epidermidis	3
Coagulase negative staphylococci	1
Staphylococcus capitis	4
Staphylococcus warneri	2
Enterococcus faecalis	1

After comparison of the results from the disc spaces and the wound drain tips, there were in ten cases a positive culture from the wound drainage and a negative culture from the disc space and in 7 cases a positive result from the disc space with negative wound drain cultures. In two cases a positive culture was obtained from disc space and wound drainage tip.

In 181 patients (24 with positive cultures from the disc space) we could analyse the time course of the sedimentation rate (S.R.). An increase of S.R. was noticed in every patient on the first postoperative day, independent of the findings of the cultures. Even at the day of discharge (about the 7th postoperative day) a further increase of the S.R. was evident, but also without any relation to the findings of the cultures. The pre-operative value of the S.R. also showed no significant differences in "culture positive" and "culture negative" patients.

The time course of the body temperature was analysed in 226 patients. Of the 33 with positive intraoperative specimen, 50% had pre-operatively an elevated temperature above 37.0 °C. In the patients with negative specimen only 36% had a pre-operative elevated body temperature (> 37.0 °C). During the hospital course the body temperature rose in both groups

mildly above 37.0 °C and in only a few patients markedly above 37.0 °C without significant difference in these two groups.

Only one patient developed clinical signs of a spondylodiscitis. The radiological findings supported the diagnosis. In this patient the intra-operative specimen was negative; the specimen from the operating microscope revealed enterobacter cloacae. Unfortunately we could not perform a biopsy for comparison.

Discussion

The aetiology of spondylodiscitis (used synonyma: spondylitis, discitis, osteomyelitis), since the first description by Milward in 1936 is still a matter of debate[6]. For review see Dauch[6], Kemp[10], and Onofrio[13]. The bacteriological pathogenesis was proven by intra-operative findings[19, 20, 25] and needle biopsies[5–7, 14, 17, 25]. As a cause for possible iatrogenic inoculation the performance of discography was discussed[19], as well as myelography, lumbar puncture, and "paravertebral" injections[6]. The most common organisms are staphylococcus aureus and staphylococcus epidermidis. This is in accordance with our findings and with reports about the most common organisms in all neurosurgical procedures[9, 24]. There are also reports of sterile biopsies[23], which led to the term of "aseptic discitis" or "aseptic bone necrosis".

Besides a iatrogenic infection there is also evidence for spontaneous development of spondylodiscitis. In these cases the origin of the infection can often only be suspected. A common cause is a preceeding infection of the genito-urinary tract. Pre-operative elevated sedimentation rates are suggestive of pre-existing infections[22]. In our study however, no significant difference between the patient groups with and without intra-operative positive specimen regarding the S.R. was obtained. Batson[1] demonstrated the communication between the epidural venous plexus and the veins from the pelvis. From there haematogeneous spread to the intervertebral disc space can only occur via the veins of the vertebral body into the avascular disc. It is surprising, however, that the infectious changes according to the radiological findings take place in the bradytrophic tissue of the nucleus pulposus; changes of the vertebral end plate and the vertebral body occur secondarily. In our opinion, the term osteomyelitis is not correct for this condition, because it implies a primary infection of the bone.

In this study, in 17% of the patients a positive specimen from the intervertebral disc space was obtained and in 12% from the covering of the operating microscope. On the other hand, only one case out of 412 developed clinical spondylodiscitis. The infection rate of 0.2% is very low and is comparable to that reported in the literature[3, 21, 22] and with an earlier report from our department[12]. These findings can be explained as follows: First: there are other possible predisposing factors in addition to a iatrogenic contamination during surgery, such as concurrent infections or immunodeficiencies, which can exacerbate an otherwise silently occurring infection. In the literature many concurrent infections as sources for a spondylodiscitis are mentioned. Infections of the urogenital tract[7, 10, 13] and the upper respiratory tract[7, 11] are the most common. A higher incidence of infection of the disc space was also reported in patients with diabetes[7, 10]. Second: the routinely performed irrigation could reduce or almost abolish the number of organisms at the operating site. One would expect, however, much higher infection rates in hospitals which do not treat the disc space with antiseptic or antibiotic solutions. Third: we can not absolutely rule out contamination of the specimen during transport to the microbiological laboratory, causing false positive results. The incidence of 9% positive cultures from the wound drainage tips can be explained by the potential risk of contamination during drainage removal (removal in the patient's bed, incomplete disinfection of the surgeon's hands or the patient's back). The high incidence of positive cultures from the covering of the operating microscope implies this to be a possible additional source of infection. Taking into account that almost all lumbar disc operations at our institution are performed microsurgically, the low incidence of clinical manifestation of spondylodiscitis (0.2%) and the finding that the specimen from the disc space and the operating microscope were identical in only 5 of 29 cases, one should not overemphasize the infection risk of the operating microscope.

In conclusion our findings indicate a high likelihood of intra-operative contamination of the disc space during the surgical intervention; using the operating microscope can be an additional risk. We propose that the low incidence of clinical manifestation of spondylodiscitis is due to careful pre-operative screening for concurrent infections and intra-operative irrigation of the disc space with an antiseptic (polyvidon-iodine) or antibiotic (neomycin sulphate) solution.

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