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Application of titanium and polyetheretherketone cages in the treatment of pyogenic spondylodiscitis

Markus Schomacher[a], Tobias Finger[a], Daniel Koeppen[b], Olaf Süss[c], Peter Vajkoczy[a], Stefan Kroppenstedt[d], Mario Cabraja[a,*]

[a] Department of Neurosurgery, Charité-Universitätsmedizin Berlin, Berlin, Germany
[b] Department of Neurosurgery, Bundeswehrkrankenhaus Koblenz, Koblenz, Germany
[c] Department of Spine Surgery and Neurotraumatology, DRK Kliniken Westend, Berlin, Germany
[d] Department of Orthopedic Surgery, Sana Kliniken Sommerfeld, Kremmen, Germany

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ABSTRACT

Objective: Surgical treatment of a pyogenic spondylodiscitis (PSD) involves a fixation and debridement of the affected segment combined with a specific antibiotic therapy. To achieve a proper stability and to avoid pseudarthrosis and kyphotic malposition many surgeons favour the interposition of an anterior graft. Besides autologous bone grafts titanium (TTN) cages have gained acceptance in the treatment of PSD. Polyetheretherketone (PEEK) cages have a more favourable modulus of elasticity than TTN. We compared both cage types. Primary endpoints were the rate of reinfection and radiological results.
Methods: From 2004 to 2013 51 patients underwent surgery for PSD with fixation and TTN or PEEK cage-implantation. While lumbar patients underwent a partial discectomy by the posterior approach, discs of the cervical and thoracic patients had been totally removed from anterior. Clinical and radiological parameters were assessed in 37 eligible patients after a mean of 20.4 months. 21 patients received a PEEK- and 16 patients a TTN-cage.
Results: A reinfection after surgery and 3 months of antibiotic therapy was not observed. Solid arthrodesis was found in 90.5% of the PEEK-group and 100% of the TTN-group. A segmental correction could be achieved in both groups. Nonetheless, a cage subsidence was observed in 70.3% of all cases. Comparison of radiological results revealed no differences between both groups.
Conclusions: A debridement and fixation with anterior column support in combination with an antibiotic therapy appear to be the key points for successful treatment of PSD. The application of TTN- or PEEK-cages does not appear to influence the radiological outcome or risk of reinfection, neither does the extent of disc removal in this clinical subset.

1. Introduction

The key steps for the surgical treatment of a pyogenic spondylodicitis (PSD) are the fixation and debridement of the affected segment in combination with a specific antibiotic therapy [1]. The fixation and anterior column support allows a direct postoperative mobilization and has the advantage of lower rates of pseudarthrosis and kyphotic segmental malposition [2,3].

Titanium (TTN) cages have been proven to provide good radiological outcomes and a high resistance to microbial adherence in the treatment of PSD [4–6]. Nonetheless, polyetheretherketone (PEEK) cages were shown to be reliable grafts in small published case series involving no more than 10 cases [7–10]. A recently published study examined 19 patients that had received a PEEK cage, but lacked radiological results [11]. However, resistance to microbial adherence is not widely accepted compared to TTN.

TTN-cages have been criticized due to a higher elasticity modulus, which could result in subsidence [12]. Nonetheless, due to structural properties TTN implants show a good osseointegration [13].

PEEK-cages have a modulus of elasticity closely resembling that of cortical bone, which might lead to advantages in load sharing and stress distribution. This might result in a lower subsidence rate with less loss of segmental correction and potentially higher fusion rate [14–16], especially in cases of PSD that often feature dissolved endplates.

* Corresponding author at: Joint Spine Center, Department of Special Orthopedic Surgery, Vivantes Auguste-Viktoria-Klinikum, Rubensstr. 125, 12157 Berlin, Germany. Tel.: +49 30 130 20 2391; fax: +49 30 130 20 2357.
E-mail address: mario.cabraja@vivantes.de (M. Cabraja).

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The aim of the present study was to compare both grafts directly, and the primary endpoints were the rate of reinfection and radiological results.

2. Methods

2.1. Patient collective

From 2002 to 2013 according to our records a total of 51 patients underwent surgery for a PSD with application of TTN or PEEK cages. Patients that did not appear to at least 6-months follow-up were excluded (see Fig. 1).

The study conforms to the Helsinki Declaration, and to local legislation. By making sure of the patients' anonymity, approval of our institutional ethics committee is not required for this retrospective study.

The included patients experienced mainly back or neck pain as main symptoms and elevated levels of biochemical infection marker proteins (C-reactive protein). Indications for surgery were intolerable pain, presence of an intraspinal abscess, development of neurologic symptoms, treatment resistance by antibiotic therapy alone and spinal instability.

2.2. Surgery

Surgery was performed in supine position by a midline skin incision after induction of general anaesthesia. Patients suffering from thoracal or lumbar infections received a posterior screw-rod-system. For stabilizing the cervical spine a screw-plate-system was used. All patients received stabilizing devices, even if the patients lacked signs of instability in the radiological examination. While lumbar patients underwent a partial discectomy by the posterior approach, discs of the cervical and thoracic patients had been totally removed. After the removal of the disc, preparation of the endplates with a rongeur and decompression of the nerval structures the intervertebral space was filled with an empty, open-box synthetic cage.

The patients received either a TTN cage or a PEEK cage from different companies. The choice of the cage material depended on the surgeon's personal preference. For vertebral body replacement only TTN-implants were available (7 cases).

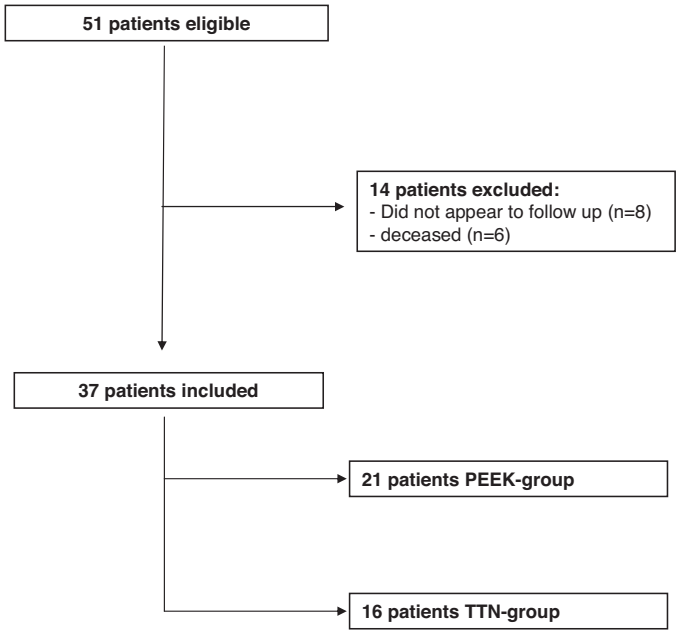

Fig. 1. Patient flow.

After surgery, all patients were treated by the same protocol, which consisted of antibiotic therapy for 12 weeks in total (2–4 weeks intravenous and 8–10 weeks oral therapy). The antibiotic therapy was empirically started during surgery immediately after samples had been obtained, usually clindamycin and fosfomycin. If a microbiological agent was detected before (by blood samples, urinary controls, etc.) the treatment was started according to the existent antibiogram until the results of the intraoperative samples were available. A cervical collar or a brace were not applied.

2.3. Clinical and radiological evaluation

Follow-up examinations were performed on an outpatient basis in our department. The criterion for a successful healing process was the clinical and laboratory development of the patients. Due to the different clinical presentation (systemic/local origin, neurologic symptoms vs. pain only, cervical/thoracal/lumbar spine) and numerous published studies on clinical outcome after surgery of PSD the clinical outcome was not assessed for this study. Thus, the primary clinical endpoint of the study was the rate of reinfection.

Radiographic examinations included pre- and postoperative plain and functional radiography, CT, myelography and magnetic resonance imaging (MRI). Radiological analysis involved the measurement of pre- and postoperative segmental angles. Due to different spinal locations of the PSD the assessment of correction was performed by comparison of the relative segmental alteration: ratio of postoperative and pre-operative segments. A value of >1 displayed a segmental correction, a value of <1 indicated a loss of segmental correction.

At the last follow-up the occurrence of anterior and posterior bone bridging as well as cage subsidence ($\geq$2 mm) [17] were assessed. Solid arthrodesis was rated according to the following accepted criteria [18–21]: The operated segment was rated as a solid arthrodesis, if movement of less than 2° was measured on lateral flexion-extension radiographs. Movement of $\geq$2° on flexion/extension radiographs or the presence of radiolucencies around a large area of the cages was regarded as a pseudarthrosis [18,22]. Furthermore, intervertebral bone formation was assessed by CT-scans in 22 of our 37 cases.

Measurements were done on digital radiographs using integrated software to measure angles and distances up to the accuracy of 0.1° and 0.01 mm, respectively (Centricity Enterprise Web, General Electric Medical Systems, Chalfont St Giles, United Kingdom).

2.4. Statistical analysis

The statistical evaluation was performed using PASW Statistics 18, Version 18.0.0 (SPSS Inc.). Statistical analysis of ASD and gender was performed by Pearson's chi-square test. The clinical and radiological data were analyzed by the Mann–Whitney *U*-test, Chi-square-test and Student's *t*-test. A *p*-value <0.05 was deemed as statistically significant.

3. Results

37 of 51 eligible patients (24 men and 13 women) were evaluated. The patients' age at time of surgery ranged from 42 to 81 years, with a mean of 62.4 years. The demographic data did not differ between the groups. The follow-up period ranged from 6 to 81 months (mean: 20.4 months).

21 patients developed a PSD due to a systemic infection, and 16 patients had undergone a prior spine intervention (surgery or infiltration) before. All deceased patient that had been excluded