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The effectiveness of pedicle screw immersion in vancomycin and ceftriaxone solution for the prevention of postoperative spinal infection: A prospective comparative study

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ABSTRACT

Objective: The aim of this study was to evaluate the efficacy of the local application of vancomycin hydrochloride (HCl)–ceftriaxone disodium hemiheptahydrate onto implants before using them to prevent postoperative infection.
Methods: The study included 239 patients (153 women and 86 men; mean age: 48.23 ± 16.77 years) who had thoracolumbar stabilization with transpedicular screws. All surgeries were performed by the same surgeon. Patients were divided into two groups. In the group 1 (n = 104), implants were bathed in a solution of local prophylactic antibiotics for 5 seconds just before implantation. In the group 2 (n = 135), implants were not bathed before implantation. Local antibiotics used in the study was effective against gram positive bacteria (including methicillin resistant *Staphylococcus aureus*) and gram negative bacteria. The rate of surgical site infection and wound healing time were compared between the groups.
Results: A total of 10 patients (4.1%) had deep wound infection and 20 (8.4%) had superficial infection. The most common bacteria was Staphylococcus aureus. One patient died 21 days after the surgery because of sepsis. The wound healed in a mean of 9.66 ± 2.04 days in patients who had no infection and in 32.33 ± 19.64 days in patients with infection ($p < 0.001$). The patients in group 1 had significantly less deep infection than the patients in group 2 ($p < 0.05$). However, there was no statistically significant difference between the groups for superficial infection. Patients with vertebral fracture had significantly lower deep infection rate in group 1. The deep infection rate of group 1 patients with diabetes, with bleeding of more than 2000 mL, transfused with blood transfusions above 3 units and with dural injury was significantly lower than those in the group 2. None of the patients had allergic reactions to the drugs used for local prophylaxis.
Conclusions: This study shown that bathing implants in antibiotics solution was an effective local prophylactic method to prevent deep infections in spinal surgeries with instrumentation.
Level of Evidence: Level III, Therapeutic study.

Introduction

Surgical site infection (SSI) is a serious complication of spinal surgery. It is reported in 0.7%–14% of patients who undergo spinal surgeries involving instrumentation.[1–8] SSI can be either superficial or deep. If the infection extends under the paravertebral fascia, it is defined as deep SSI. Deep SSI involves long hospital stays, repeated surgeries, removal of the spinal implant and increased incidence of developing pseudoarthrosis, resulting in high hospitalization costs.[9]

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Microorganisms generally stick to the surface of spinal implants and are, thus, transferred to the surgical site during surgery; in addition, they may appear on implants in a case of permanent bacteraemia after the surgery. Spinal implant surgeries are associated with an increased risk of infection owing to the bacterial biofilm layer that grows on the surface of implants, which is resistant to antibiotics.[10] The gold standard in infection control is preventing the development of SSI, which can be achieved by various methods.

This study primarily aimed to evaluate the efficacy of the local application of vancomycin hydrochloride (HCl)–ceftriaxone disodium hemiheptahydrate onto implants prior to their use in surgeries to prevent postoperative infection.

Material and methods

This prospective study was approved by the local ethics committee of the hospital on 25 February 2006 (number B.02.1.VGM.2.03.01). Written informed consent was obtained from all patients. Patients who were treatment via posterior thoracolumbar stabilization with transpedicular screws and posterolateral fusion in our neurosurgery clinic were included in this study. Between March 2006 and June 2009, 260 consecutive cases were treated. Eighteen patients were excluded owing to a preoperative diagnosis of spondylodiscitis or because of a known allergy to some drugs, which were to be used in the study. In addition, three patients were excluded because they did not follow-up. Therefore, in total, 239 cases were included in this study.

Cefazolin sodium (1 gm) was intravenously injected in all the patients 30 min prior to the skin incision. Furthermore, 1 g of cefazolin sodium was postoperatively administered for 24 h (3 × 1, every 8 h") for routine prophylaxis. The surgeries were all performed by the same spinal surgeon. The fascia was closed with #1 polyglactin (MEDSORB PGLA®, Medeks, Istanbul, Turkey), the subcutaneous tissue was closed with #2/0 polyglactin (PEGESORB®, Dogsan, Trabzon, Turkey) and the skin was closed with #2/0 polypropylene (PROPİLEN®, Dogsan, Trabzon, Turkey) in all the patients. A drain was placed in each patient that was removed on the first postoperative day. In the hospital, the authors evaluated the wounds daily until complete closure of the wound. Superficial and deep infections were distinguished by a neurosurgeon along with a specialist in infectious diseases based on examination and MRI with contrast. In cases exhibiting flux from the surgery site, culture samples were collected from the wounds and were examined in our microbiology laboratory. Both before surgery and one week after surgery, blood glucose levels, white blood cell (WBC) counts, haemoglobin and haematocrit values, C-reactive protein (CRP) levels and erythrocyte sedimentation rates (ESRs) were examined for each patient. In addition, daily WBC, ESR and CRP levels were measured in patients diagnosed with an infection. All SSI cases were treated by the author, who is an infectious disease specialist. Each SSI case was followed from its diagnosis to wound healing, and the number of days to reach complete wound healing was prospectively recorded for all such cases. The patients were followed for an average of 1.2 years (range: 21 days–3.5 years) for SSI.

Study groups

The broad-spectrum antibiotics for the local prophylaxis solution were selected based on the microorganisms present at the infection site (gram-positive bacteria including methicillin-resistant *Staphylococcus aureus* and gram-negative bacteria). To prepare the solution, vancomycin HCl (Edicin i.v. 500 mg 1 Flakon; Sandoz, Istanbul, Turkey) powder and ceftriaxone disodium hemiheptahydrate (Cefaday i.v. 1000 mg 1 Flakon; Biofarma, Istanbul, Turkey) powder were dissolved in 250 ml of saline (Fig. 1a and b). The patients were divided into two groups. In group 1 (n = 104), the implants were bathed in the local prophylactic antibiotics solution for 5 s just before implantation (Fig. 1c). In group 2 (n = 135), the

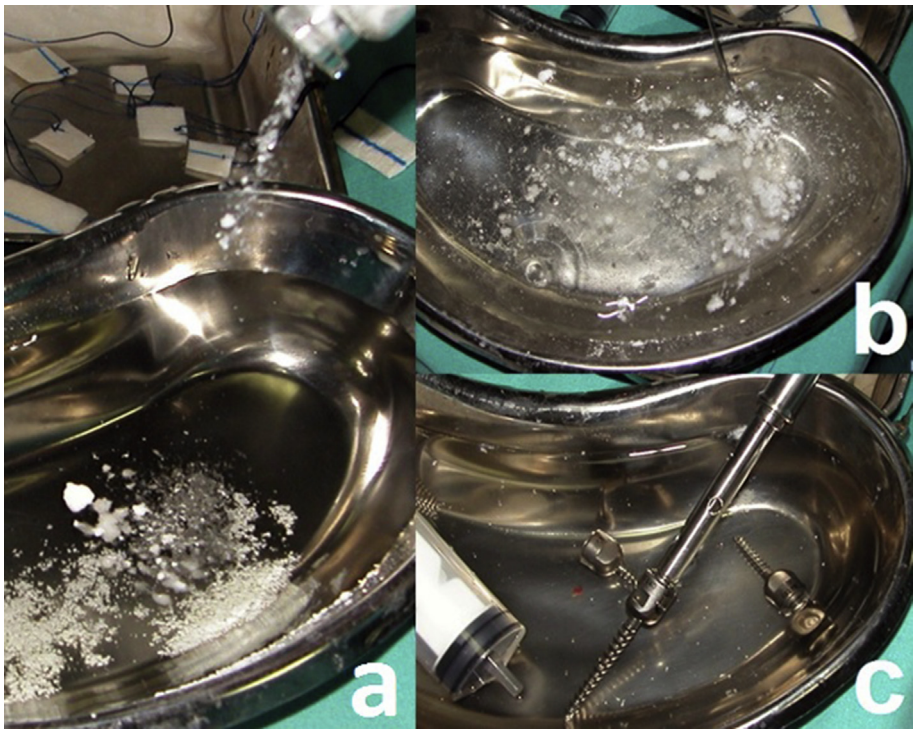

Fig. 1. To prepare the solution, a) The antibiotics powder are unpacked and, b) Dissolved in 250 ml saline. c) Implants are bathed in the solution of local prophylactic antibiotics just before implantation.

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