



O5:101

A new implant technology: iodine-coating for infection control

Hiroyuki Tsuchiya¹, Toshiharu Shirai¹, Hideji Nishida¹

¹ Graduate School of Medical Science, Kanazawa University, Japan

Background

Post-operative infection associated with implants remains a serious complication in orthopedic surgery. For example, infection rates between 5% and 35% have been described for endoprosthetic replacement of large bone defects after tumor resection despite strict antiseptic operative procedures, including systemic prophylaxis. Several biomaterial surface treatments have been proposed for reducing the incidence of implant-associated infections. We have done a basic experiment for the iodine-supported titanium. The results indicate that iodine-supported titanium has favorable antibacterial activity, biocompatibility, and no cytotoxicity. In this study, a clinical trial was performed using iodine-supported titanium implants in orthopaedic surgery.

Patients and Methods

A total of 344 patients with post-operative infection or compromised status were treated using iodine-supported titanium implants. The mean age of the patients was 49.3 years (range, 5-86 years). The mean follow-up period was 26 months (range, 3-44 months). One hundred ninety-two patients were male and 152 were female. The diagnoses included 157 cases of tumor, 56 of degenerative disease, 35 of limb deformity, 30 of infected pseudoarthrosis, 24 of fracture, 6 of osteonecrosis, 5 of rheumatoid arthritis and one of scoliosis. Iodine-supported implants were used to prevent infection in 257 patients with compromised status (diabetes, cancer, steroid treatment, open fracture etc.), and to treat active infection for 87 patients. White blood cells (WBCs) and C-reactive protein (CRP) were measured pre- and post-operatively in all patients. To confirm whether iodine from the implant affected physiological functions, plasma thyroid hormone levels were examined. Both examinations were conducted sequentially for a year. Radiological evaluations were performed regularly after the operation. The chronological changes of the iodine amount were evaluated using half pins and screws removed after completion of treatment.

Results

The following types of implants were used: 129 spinal instrumentations, 79 plates for osteosynthesis, 71 prostheses, 56 external fixation (pins and wires), seven nails and two cannulated screws. Acute infection developed in three tumor cases and one in diabetic foot among the 257 patients on preventive therapy. In one patient, infection was cured by debridement and removing only the Marlex mesh used to reconstruct chest wall while leaving the iodine-coated implants in place. Other three infected cases were also cured by intravenous administration of antibiotics only, without removal of the implants. The 87 treatment cases that underwent one-stage or two-stage revision surgery recovered without additional surgery. Median WBC levels were in the normal range and median CRP levels returned to < 0.5 within 4 weeks after surgery. Abnormalities of thyroid gland function were not detected. None of the patients experienced loosening of the implants. There were two patients with mechanical implant failure, which was treated by re-implantation. Excellent bone ingrowth and ongrowth were found around all hip and tumor prostheses. One year later, the amount of iodine on external fixation pins remained about 30%.

Conclusions

Iodine-supported titanium implants can be very effective for preventing and treating infections after orthopaedic surgery. Cytotoxicity and adverse effects were not detected.