25th ICC / 11th ECCMID
31 March – 3 April 2007, Munich Germany

The ISC Working Group on Biomaterial Related Infections organised and sponsored the following symposium at the above meeting.

Incidence and prevention of biomaterial-associated infections

The topics to be covered include

1) Incidence of biomaterial-associated infections
2) Preventive measures of biomaterial-associated infections
3) Material modifications with antimicrobial and disinfectant technologies
4) Material modifications with silver technologies.

Abstracts of the above lectures are detailed on the following pages.

Material modification of implantable biomaterials by Nanoparticles of silver and other alloys in polyurethane

J. Peter Guggenbichler
Department Pediatric Infectious Diseases and Preventive Medicine, Univ. Erlangen/Nürnberg, Germany

Health care associated infections are the fourth leading cause of disease in industrialised countries and the most common complication affecting hospitalized patients. The disruption of the integrity of the surface by implantable medical devices and direct and indirect access of microorganisms into the respiratory tract, the urogenital tract, bloodstream and cerebrospinal space as well as the ease of colonisation of plastic implants are the reason that biomaterials are attributable for at least two thirds of nosocomial infections. Despite preventive measures which include strict adherence to hygienic rules, vigorous barrier precautions during insertion or implantation of various devices as well a continuing education more than 175 000 deaths per year are observed in Europe.
Presently available preventive measures including various material modifications with antibiotics and disinfectants have not been found satisfactory in the prevention of biomaterial associated infections.
The invention describes the incorporation of nanoparticles of silver, fixed on an anorganic carrier alone, in combination with water insoluble silver salts, various alloys of silver with copper, platinum, gold, zirconium or trihydroxides of molybdenum or tungsten in plastics. This technology prevents the colonisation and biofilm formation on the surface of implantable biomaterials and shows excellent antimicrobial activity in vitro. Catheters impregnated with billions of nanoparticles show bactericidal activity on the outside and the various lumina and excellent biocompatibility. Three prospective, randomised investigator blinded clinical studies show a reduction of infections attributed to implantable short term and long term biomaterials in a range of 72% – 95 % with reduction of the incidence and the mortality of nosocomial infections.
Implantable biomaterials endowed with the oligodynamic activity of metal ions are able to influence the cost of health care favourably.

Teatment concepts for prosthetic joint associated infections

Werner Zimmerli
Basel University Medical Clinic Liestal, Switzerland

Prosthetic-joint replacement has a major impact on the quality of life in people with arthritis, osteoarthrosis, and bone fractures. This procedure allows to alleviate pain and to restore function, often resulting in more rapid return at work. However, since implants are highly susceptible to infection [1] , there is a considerable risk for this complication. The infection rate is 0.5-2% after joint-replacement. Since the costs of each device-associated infection episode is 3-5times higher than the initial intervention, efficacious prevention and evidence-based treatment are of paramount importance.

The most commonly cultured microorganisms in orthopaedic device-related infections are: coagulase-negative staphylococci (30-45%), *Staphylococcus aureus* (12-25%), streptococci (10%), gram-negative bacilli (3-6%), enterococci (3-7%, and anaerobes (2-4%) [2]. Mixed infections occur in 10% of the cases. They are especially frequent after healing disturbance or sinus tract formation. This spectrum indicates that most microorganisms are originating from the skin.

The management of prosthetic-joint associated infection is not well standardized. Until recently, two-stage exchange or life-long antibiotic suppression therapy has been the rule, at least in the US. During the last decade, new treatment concepts have been developed [3]. These concepts include different aspects of antimicrobial therapy on the one hand and surgical aspects on the other hand. An efficacious antimicrobial agent against device-associated infections should penetrate the biofilm, be active on surface-adhering and stationary-phase bacteria and have a good oral bioavailability. The goal of treating infection associated with a prosthetic joint is a pain-free, functional joint. This can best be achieved by eradication of the infection. Treatment options of such infections are: débridement with retention, one-stage exchange, two-stage exchange with or without temporary spacer, permanent removal of the device or life-long suppressive antibiotic therapy. Not all options fulfil the above mentioned treatment aims. Each surgical treatment option should be combined with a long-term antibiotic treatment, preferably with an agent acting on slow-growing and adhering microorganism. This requirement is only fulfilled by rifampin in staphylococcal infection and by fluoroquinolones in infections due to gram-negative bacilli [4,5]. We developed an algorithm indicating the optimal therapeutic option for each patient [3]. If this algorithm is respected, there is no difference between the success rate of patients with device retention, one-stage or two-stage exchange. A success rate of 80-90% can be expected [6,7].

In conclusion, the novel treatment concepts for the choice of the optimal surgical procedure for patients with orthopaedic device-related infection should replace the dogma that each infected device has to be removed or replaced by a two-stage exchange.

References

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