ORTHOPEDIC INFECTION pdf

1: Orthopaedic Surgery | Principles of Orthopedic Infection Management

Treatment for orthopedic infections primarily involves antibiotic therapy. However, the difficulty in treating biofilm infections in an avascular environment often necessitates surgical revision to remove the infected implant (Lamagni et al.,). For this reason, prevention of infection is most effective.

Immediate access to this article To see the full article, log in or purchase access. Address correspondence to Alan R. Reprints are not available from the authors. CDC definitions of nosocomial surgical site infections, Infect Control Hosp Epidemiol. Guideline for prevention of surgical site infection, Health and economic impact of surgical site infections diagnosed after hospital discharge. The impact of surgical-site infections following orthopedic surgery at a community hospital and a university hospital: Recognition, prevention, surveillance, and management of surgical site infections: The impact of surgical-site infections in the s: The surgical infection prevention and surgical care improvement projects: Antimicrobial prophylaxis for surgery. Treat Guidel Med Lett. Antimicrobial prophylaxis for surgery: Adherence to surgical care improvement project measures and the association with postoperative infections. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. N Engl J Med. Antibiotic prophylaxis and the risk of surgical site infections following total hip arthroplasty: Timing of antimicrobial prophylaxis and the risk of surgical site infections: Making health care safer. A critical analysis of patient safety practices. Agency for Healthcare Research and Quality; Use of antimicrobial prophylaxis for major surgery: American Academy of Family Physicians. Facts about family medicine. Accessed March 18, Efficacy of prophylactic antibiotic therapy in spinal surgery: Single-versus multiple-dose antimicrobial prophylaxis for major surgery. Aust N Z J Surg. Single-versus multiple-dose antibiotic prophylaxis in the surgical treatment of closed fractures: Perioperative strategies for decreasing infection: J Bone Joint Surg Am. Intraoperative redosing of cefazolin and risk for surgical site infection in cardiac surgery. Antibiotic pharmacodynamics in surgical prophylaxis: Methicillin-resistant Staphylococcus aureus outbreak: Am J Infect Control. Glycopeptides are no more effective than beta-lactam agents for prevention of surgical site infection after cardiac surgery: Vancomycin versus cefazolin prophylaxis for cardiac surgery in the setting of a high prevalence of methicillin-resistant staphylococcal infections. J Thorac Cardiovasc Surg. Surgical site infections associated with methicillin-resistant Staphylococcus aureus: Preventing surgical-site infections in nasal carriers of Staphylococcus aureus. Mupirocin ointment for preventing Staphylococcus aureus infections in nasal carriers. Cochrane Database Syst Rev. Universal screening for methicillin-resistant Staphylococcus aureus at hospital admission and nosocomial infection in surgical patients. The Society of Thoracic Surgeons practice guideline series: Surgical site infection prevention and control: Skin and soft-tissue infections caused by methicillin-resistant Staphylococcus aureus [published correction appears in N Engl J Med. Randomized clinical trial of single- versus multiple-dose antimicrobial prophylaxis in gastric cancer surgery. The Society Of Thoracic Surgeons practice guideline series: Alteration of vancomycin pharmacokinetics during cardiopulmonary bypass in patients undergoing cardiac surgery. Am J Health Syst Pharm. Prolonged antibiotic prophylaxis after cardiovascular surgery and its effect on surgical site infections and antimicrobial resistance. Efficacy of antibiotic prophylaxis before the implantation of pacemakers and cardioverter-defibrillators: Tejwani NC, Immerman I. Myths and legends in orthopaedic practice: Clin Orthop Relat Res. Antibiotic prophylaxis for cardiac surgery.

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2: Principles of Orthopedic Infection Management 1st Edition â€“ Books

Orthopedic Infection Advisory (OIA) is dedicated to educating healthcare professionals about the risks and consequences of orthopedic infections. OIA monitors scientific publications for published research relating to such infections, with particular emphasis on peri-prosthetic infections.

The practitioner might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures. Limited Evidence Moderate strength evidence finds that dental procedures are unrelated to implant infection and that antibiotic prophylaxis prior to dental procedures does not reduce the risk of subsequent implant infection. There is no direct evidence to support otherwise. High strength evidence suggests that antibiotic prophylaxis reduces the incidence of post-dental procedure related bacteremia, but there is no evidence that these bacteremias are related to prosthetic joint infections. A single well-conducted case-control study provides direct evidence for this recommendation. Study enrollment consisted of patients with prosthetic hip or knee infections cases and patients with hip or knee arthroplasties without infection controls hospitalized on an orthopaedic service during the same time period. The comparison between these groups was for differences in dental visits exposure in terms of high and low-risk dental procedures, with and without antibiotic prophylaxis. Neither dental procedures nor antibiotic prophylaxis prior to dental procedures were associated with risk of prosthetic hip or knee infections. The authors performed a sample size calculation and withdrawals were low, minimizing attrition bias. The prospective nature of this study minimized recall bias. Additionally, blinding of the treatment group to those assessing outcomes limits detection bias. Although this one study of direct evidence was of moderate quality, it did have limitations. The authors conducted covariate analysis on some subgroups of higher risk patients. The number of patients in these subgroups, however, was relatively small, and there is insufficient data to suggest that these patients are at higher risk of experiencing hematogenous infections. There is high quality evidence that demonstrates the occurrence of bacteremia with dental procedures. Historically, there has been a suggestion that bacteremias can cause hematogenous seeding of total joint implants, both in the early postoperative period and for many years following implantation. It was felt that the most critical period was up to two years after joint placement. In addition, bacteremias may occur during normal daily activities such as chewing and tooth brushing. It is likely that these daily activities induce many more bacteremias than dental procedure associated bacteremias. While evidence supports a strong association between certain dental procedures and bacteremia, there is no evidence to demonstrate a direct link between dental procedure associated bacteremia and infection of prosthetic joints or other orthopaedic implants. However, dental procedure associated bacteremia is a surrogate outcome for prosthetic joint infection. Surrogate outcomes may or may not relate to a clinically relevant patient outcome. Of additional concern is a positive surrogate outcome e. This recommendation is limited to patients with hip and knee prostheses because the single study of direct evidence included only patients with these types of orthopaedic implants. There is no direct evidence that met our inclusion criteria for patients with other types of orthopaedic implants. We are unable to recommend for or against the use of topical oral antimicrobials in patients with prosthetic joint implants or other orthopaedic implants undergoing dental procedures. Inconclusive There is high quality evidence that demonstrates the occurrence of bacteremias with dental procedures. However, there is no evidence to demonstrate a direct link between dental procedure associated bacteremia and infection of prosthetic joints or other orthopaedic implants. There is conflicting evidence regarding the effect of antimicrobial mouth rinse on the incidence of bacteremia associated dental procedures. One high quality study reports no difference in the incidence of bacteremia following antimicrobial mouth rinsing in patients undergoing dental extractions. Conversely, numerous studies suggest that topical antimicrobial prophylaxis decreases the incidence of dental procedure associated bacteremia. However, there is no evidence that application of antimicrobial mouth rinses before dental procedures prevents infection of prosthetic joints or other orthopaedic implants. In the absence of reliable evidence linking poor oral health to prosthetic joint infection, it is the opinion of the work group that patients with prosthetic joint implants or other orthopaedic

implants maintain appropriate oral hygiene. Consensus The lack of evidence relating oral bacteremias to prosthetic joint or other orthopaedic implant infections is the basis for the consensus rationale for this recommendation. Oral hygiene measures are low cost, provide potential benefit, are consistent with current practice, and are in accordance with good oral health. There is evidence of the relationship of oral microflora to bacteremia. This bacteremia may be associated with poor oral hygiene. This implies that improvement of oral hygiene or maintenance of good oral hygiene may be beneficial in reducing bacteremias.

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3: OrthoGuidelines

An APIC Guide Guide to the Elimination of Orthopedic Surgical Site Infections About APIC APIC's mission is to improve health and patient safety by reducing risks of infection and.

Cemented prostheses are anchored with polymethylmethacrylate. The cementless prosthesis is fixated through bony ingrowth into a porous coating applied to the surface. Bonding can also be accomplished through the application of a hydroxyapatite compound to the surface of the components, stimulating new bone formation and serving as an attachment for newly formed osseous tissue. Acetabular components can be forced, or press-fit, into the acetabulum and secured with orthopedic screws, as needed 1. Although many complications of prosthetic joint surgery are readily diagnosed and treated, differentiating aseptic loosening from infection can be difficult because the clinical presentation of, and the histopathologic findings in, both entities are often similar 2 , 3. Particulate debris, produced by component fragmentation, activates tissue phagocytes normally present around the prosthesis. This debris, resistant to enzymatic destruction, thwarts the inflammatory cells, resulting in repeated, failed, attempts at phagocytosis. The continuing attempts at phagocytosis stimulate proinflammatory cytokine and proteolytic enzyme secretion, damaging bone and cartilage and leading to osteolysis, loss of supporting osseous tissues, and loosening of the prosthesis. The cellular composition of the pseudomembrane is varied: Approximately one third of these infections develop within 3 mo, another third within 1 y, and the remainder more than 1 y after surgery. The inflammatory reaction accompanying the infected prosthesis is nearly identical to that present in aseptic loosening, with an important difference: Because their treatments are very different, the importance of accurate preoperative differentiation of aseptic loosening from infection cannot be overemphasized. Aseptic loosening can be treated with a single-stage revision arthroplasty requiring only 1 hospital admission. The treatment of infected hardware is more complex. An excisional arthroplasty is performed, followed by several weeks of intravenous antibiotic therapy. Eventually, several months or more later, the patient undergoes a revision arthroplasty 1. To be useful, therefore, any preoperative diagnostic test used must be both sensitive and specific. The sensitive but nonspecific test can lead to multiple costly, unnecessary operations on patients in whom a single intervention may have sufficed. Similarly, the specific but insensitive test will also result in additional surgical interventions, because any revision arthroplasty implanted in the setting of infection will fail. Given the similarities between aseptic loosening and infection, it is not surprising that nonspecific markers of inflammation are not useful for distinguishing between these 2 entities. The results of joint aspiration have also been disappointing. Plain radiographs are neither sensitive nor specific, and cross-sectional imaging modalities, such as CT and MRI, are hampered by hardware-induced artifacts 1. Over the years, a plethora of radionuclide imaging studies has been investigated. Bone scintigraphy is ubiquitously available, easily performed, and exquisitely sensitive. For hip prostheses, diffusely increased periprosthetic uptake is often equated with infection. This appearance is probably due to generalized osteolysis, which is present in aseptic loosening secondary to inflammation as well as infection. Scintigraphically, then, these 2 entities may be indistinguishable. The diffuse pattern associated with infection was described in patients with cemented prostheses. The introduction of cementless and hybrid prostheses, among others, further complicates matters because the evolution of periprosthetic uptake patterns around these devices has not been well established 12 , Periprosthetic uptake patterns around knee prostheses are extremely variable, with asymptomatic patients often demonstrating persistent periprosthetic activity for several years after implantation 14 , Adding to the difficulty is the fact that about two thirds of all joint replacement infections occur during the first year after implantation, when, regardless of the type or location of the prosthesis, periprosthetic uptake is so variable that only a bone scan with normal findings contributes useful information. Gallium imaging is often performed to enhance the specificity of bone scintigraphy. Uptake of gallium is related to inflammation in general and not to infection specifically. Labeled leukocyte imaging is most useful for detecting neutrophil-mediated inflammatory processes. Theoretically, then, this procedure should be able to differentiate the inflamed aseptically loosened prosthesis, in which neutrophils are generally absent, from the infected prosthesis, in

which neutrophils are present. The results reported, however, have varied widely on the accuracy of this technique. The paucity of neutrophils in the aseptically loosened prosthesis, and the invariable presence of these cells in the setting of infected hardware, however, point to another explanation for the inconsistent results. Labeled leukocytes accumulate not only in infection but in the bone marrow as well. The distribution of hematopoietically active marrow is extremely variable, making it difficult, when the images are interpreted in isolation, to distinguish uptake of labeled leukocytes in infection from uptake in aberrantly located but otherwise normal marrow. This problem has been overcome by the addition of complementary bone marrow imaging performed with 99mTc-sulfur colloid. Both labeled leukocytes and sulfur colloid accumulate in the bone marrow, but only labeled leukocytes accumulate in infection. The in vitro labeling process is labor intensive, is not always available, and requires direct contact with blood products. The need to perform marrow imaging adds to the complexity and cost of the study and is an additional inconvenience to patients, who are often elderly and debilitated. Thus, the quest continues for an agent as efficacious as, but without the limitations of, the in vitro labeled leukocyte study. Methods of in vivo leukocyte labeling using peptides and antigranulocyte antibodies have been investigated, but none are approved for routine use in the United States. Abandoning radiolabeled leukocytes entirely, some investigators have recently turned to other tracers in the pursuit of an agent that can accurately identify the infected prosthesis without the limitations of the current technology. One tracer that has aroused considerable interest is 18F-FDG 20 â€” Uptake of this agent is dependent on glucose metabolism. Activated leukocytes, which are avid consumers of glucose, are present in large numbers around both aseptically loosened and infected prostheses, and this circumstance would seem to pose a serious obstacle to the success of this technique for evaluating the painful joint prosthesis. A novel approach to infection imaging is the use of radiolabeled antibiotics. The prototype of this group of tracers is 99mTc-ciprofloxacin, or Infecton Draximage Inc. The uptake mechanism of this agent, although a subject of some controversy, is presumably the same as that for the unlabeled antibiotic: Recent data indicate that, at least in orthopedic infections, this agent may be more sensitive than specific 31 , The results reported by Sarda et al. The data presented are important, not only because they raise questions about 99mTc-ciprofloxacin but also because they should move us to reanalyze our approach to the investigation of nuclear medicine techniques for diagnosing orthopedic infections. It is important to be aware that, currently, no one tracer or combination of tracers is equally satisfactory for all orthopedic infections. An agent that apparently performs well in orthopedic infection in general may be less satisfactory for a specific entity. Labeled leukocyte imaging combined with marrow imaging is extremely useful for the evaluation of the prosthetic joint but is of little or no value in spinal osteomyelitis. Similarly, labeled leukocyte imaging can be used alone to accurately diagnose pedal osteomyelitis in the forefoot of the diabetic patient but must be combined with marrow imaging for accurate evaluation of the mid and hind foot, where the Charcot joint is often present. Although initial broad-based investigations are useful to determine whether an agent merits further evaluation, it is important that these initial results, no matter how encouraging they might be, not be extrapolated to each of the various entities that we, as nuclear physicians, may be called on to evaluate. Adequate study of a new agent must include focused evaluations of specific entities: Another element critical to the successful investigation of any agent is the gold standard by which it is judged. In the case of orthopedic infections in general, and the prosthetic joint in particular, the importance of histopathologic confirmation of the diagnosis cannot be overemphasized. How does one, clinically, determine the presence or absence of infection? Laboratory tests are of limited value. Pain and osteolysis are present in both infection and aseptic loosening and are not likely to resolve with time in either entity. Moreover, what constitutes a sufficiently long period for adequate clinical follow-up: Investigations should be limited to patients who are likely to have histopathologic confirmation of the diagnosis. Finally, the investigational agent should be compared with the radionuclide imaging procedure of choice for a given entity. It is not meaningful, for example, to compare 99mTc-ciprofloxacin, or 18F-FDG, with labeled leukocyte imaging in spinal osteomyelitis. Perhaps, however, there was something unique about the population studied and no study would have performed very well. I would be far more likely to dismiss 99mTc-ciprofloxacin as a useful agent if these patients had also undergone the dual-tracer study, with the expected results. In summary, the adequate evaluation of any agent for the

diagnosis of orthopedic infection is an almost Herculean, albeit necessary, undertaking. The investigation must include focused, individual evaluations of specific problems, such as the painful replaced joint or the spine, histopathologic confirmation of the diagnosis, and comparison to the radionuclide imaging procedure of choice. For correspondence or reprints contact:

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4: NAON : Infection Prevention & Control

Infection of skin and other soft tissue can lead to infection of bones (osteomyelitis) and joints (septic arthritis). Fortunately, early diagnosis, appropriate antibiotic therapy, and surgical intervention, when required, can cure most orthopaedic infections.

Page Content Sidebar Make an appointment Our doctors work at the only comprehensive cancer center in the Rocky Mountain area. Call the cancer center at or the orthopedic clinic at to make an appointment today. Overview What are the types of infections? The technical term for a bone infection is osteomyelitis. We also treat prosthetic joint infections as well as atypical joint and soft tissue infections. Who gets bone or joint infections? Certain types of bone and joint infections develop in patients with an underlying condition of autoimmune disease or immune suppression. This could originate from rheumatoid arthritis, cancer, or an organ transplant. A history of trauma or injury to a bone, for example, can create a an infection. A fracture, deep bruise, or puncture of a foreign object can also add to your risk. People with total joint replacements that suffer an infection elsewhere in their body are at increased risk of infection in the joint that has been replaced. This requires an extensive amount of time and numerous surgeries to rectify. Infections can develop anytime after a surgery, however, and often there is not a known cause of a bone infection or reason for infection to settle into a joint. What is Prosthetic Joint Infection? The involved joint starts to swell, become painful and red, or even starts to drain. These are very difficult to eradicate and a multi-disciplinary approach is needed. These infections are caused by bacteriae related to the turbeculous bacterium. You can even get it during a sterile surgical procedure. Most of these infections occur in the lung; however, infections of the skin, soft tissue, joints and bones occur infrequently. Therefore, it is necessary when you have such an infection, to be treated in a specialized center that collects these cases and has experience in their treatment.

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5: Managing Orthopaedic Infections

The clinician dealing with orthopedic infections must be familiar with the pathogens associated with bone and joint infections, and must also know the spectrum, pharmacokinetics, side effects, and cost of antibiotics used to prevent or treat such infections.

The article may be redistributed, reproduced, and reused for non-commercial purposes, provided the original source is properly cited. This article has been cited by other articles in PMC. Abstract Staphylococcus comprises up to two-thirds of all pathogens in orthopedic implant infections and they are the principal causative agents of two major types of infection affecting bone: Bacterial adhesion is the first and most important step in implant infection. It is a complex process influenced by environmental factors, bacterial properties, material surface properties and by the presence of serum or tissue proteins. Properties of the substrate, such as chemical composition of the material, surface charge, hydrophobicity, surface roughness and the presence of specific proteins at the surface, are all thought to be important in the initial cell attachment process. The biofilm mode of growth of infecting bacteria on an implant surface protects the organisms from the host immune system and antibiotic therapy. The research for novel therapeutic strategies is incited by the emergence of antibiotic-resistant bacteria. This work will provide an overview of the mechanisms and factors involved in bacterial adhesion, the techniques that are currently being used studying bacterial-material interactions as well as provide insight into future directions in the field. Orthopedic implants, bone infections, bacterial adhesion, Staphylococcus, bacteria-material interactions Introduction Bone and joint degenerative and inflammatory problems affect millions of people worldwide. In fact, they account for half of all chronic diseases in people over 50 y of age in developed countries. In addition, it is predicted that the percentage of the population over 50 y affected by bone diseases will double by With particular reference to bone implants, mechanical and physico-chemical compatibility is required. Each type of material used in orthopedic devices has its own advantages particularly suitable for specific applications. These devices include prostheses for hip, knee, ankle, shoulder and elbow joints. They also include the fracture fixation devices such as wires, pins, plates, screws, etc. Metals Ti-6Al-4V, Co-Cr-Mo and stainless steel , polymers [poly methyl methacrylate PMMA and ultrahigh-molecular-weight polyethylene UHMWPE] and ceramics alumina, zirconia and hydroxyapatite are the three classes of materials that are most commonly used for fabricating orthopedic implants. PMMA is used for fixation of joint replacement implants. It is a challenging task to treat orthopedic implant infections that may lead to implant replacement and, in severe cases, may result in amputation and mortality. First, bacterial communities on these surfaces represent a reservoir of bacteria that can be shed into the body, leading to a chronic infection. Second, biofilm bacteria are highly resistant to treatment with antibiotics; therefore, once these bacterial communities form, they are extremely difficult to eliminate with conventional antimicrobial therapies. Finally, because host responses and antimicrobial therapies are often unable to eliminate bacteria growing in a biofilm, a chronic inflammatory response at the site of the biofilm may be produced. Therefore, inhibiting bacterial adhesion is essential to prevent implant-associated infection, because biofilm are extremely resistant to both the immune system and antibiotics. Staphylococcus Bacteria of the genus Staphylococcus are Gram-positive, nonspore forming facultative anaerobes that grow by aerobic respiration or fermentation, with diameters of 0. They are characterized by individual cocci, which divide in more than one plane to form grape-like clusters. Many Staphylococcus strains, particularly S. Nosocomial infections by S. Binding involves a family of adhesins that interact with extracellular matrix ECM components and these adhesins have been termed microbial surface components recognizing adhesive matrix molecules MSCRAMMs. Particular MSCRAMMs include fibronectin-binding proteins, fibrinogen-binding proteins, elastin-binding adhesin and collagen-binding adhesin. A number of these adhesins have already been thoroughly investigated and identified as critical virulence factors implicated in various phases of infection, including early colonization, invasion, tissue localization and cell internalization. It is known that once a biofilm has formed, the bacteria within the biofilm are protected from phagocytosis and antibiotics. The cell-surface virulence factors include the microbial surface components recognizing adhesive matrix

molecules MSCRAMMs as receptors in the human host, other surface proteins, polysaccharide intercellular adhesin and capsular polysaccharides. The role of these various virulence factors is to provide nutrients required for survival in the host, and microbial cell protection from the host immune system during lesion formation. The secreted virulence factors, typically produced during the post-exponential and stationary phases, include a large group of exoenzymes, such as proteases, glycerol ester hydrolase lipase and nucleases that make nutrients available to the microorganism. The entry door into the human body in all of these infections is usually an intravascular catheter. This biofilm is composed of an extracellular polysaccharide known as polysaccharide intercellular adhesin PIA , which is essential for S. PIA production is also known to protect S. Generally, the success of S. To date, few ECM recognizing adhesins have been identified for S. The main pathways of infection for osteomyelitis, septic arthritis and PJI are either hematogenous, resulting from bacteremia; contiguous, when the infection is transmitted from local tissue; or direct, resulting from infiltration of bone, often following injury, surgery or implantation of a foreign body, such as joint replacement. The occurrence, type, severity, and clinical prognosis of osteomyelitis depend on the interplay of a triad of factors, including the characteristics and virulence of the infecting pathogen, the properties of the host, and the source of infection. Early infections are usually related to trauma or contamination during surgery; however, a number of improvements in surgical procedures have been responsible for reducing the infection rate. Late infections, which may not occur until after a number of months postoperatively, can also result from bacterial contamination during trauma, surgery or via remote infections. In many of these cases, bacteria introduced during trauma or surgery became dormant for an extended period of time. The mechanisms of infection are quite complex and vary with the species of bacteria. If the conditions are favorable, bacteria create an initial attachment to the surface. A permanent attachment develops as protein adhesin-receptor form along with a polysaccharide film after the distance between the cell and the surface is sufficiently reduced. Because biomaterials do not elicit an antiphagocytic reaction toward bacteria after adhesion, these are able to multiply and colonize freely on implant surfaces. These factors include rheumatoid arthritis or osteoarthritis, joint prosthesis, low socioeconomic status, intravenous drug abuse, alcoholism, diabetes, previous intra-joint corticosteroid injection and cutaneous ulcers. Prosthetic joint infections The implantation of prosthetic joints along with the use of other implantable orthopedic devices e. Based on conservative estimates, millions of people worldwide have some form of prosthetic joint or other implantable orthopedic device. Among the possible complications associated with implantation, infection is the most serious and occurs in 1 to 13 percent of the cases; the resulting consequences include postoperative prosthesis failure, chronic pain and immobility. These infections are a major threat, as therapy is difficult, resulting in a significant increase in hospitalization-related morbidity and mortality. They are the most commonly reported microorganisms both in early and late infections and in total knee and hip arthroplasty. These factors include rheumatoid arthritis, immunocompromised states, diabetes mellitus, poor nutritional status, obesity, psoriasis, long-term urinary catheterization, extreme age, surgical site infection and human immunodeficiency virus HIV. Adhesion of bacteria to human tissue surfaces and implanted biomaterial surfaces is an important step in the pathogenesis of infection, whereby the bacteria can divide and colonize the surface. Bacteria may have multiple adhesins for different surfaces different receptors. A receptor is a component on the surfaces of biomaterials or host tissue that is bound by the active site of an adhesion during the process of specific adhesion. Slime, an extracellular substance exopolymers composed mainly of polysaccharides produced by the bacteria, may protect the bacteria from antibiotic therapy, physiologic shear, and possibly host cell-mediated defenses. Bacterial strains that do not produce slime are less adherent and less pathogenic. Within biofilms, bacterial cells develop into organized and complex communities with structural and functional heterogeneity resembling multicellular organisms in which water channels serve as a rudimentary circulatory system. Release of cell-to-cell signaling molecules quorum sensing induces bacteria within a population to respond in concert by changing patterns of gene expression involved in biofilm differentiation. Both specific and non-specific interactions may play an important role in the ability of the cell to attach to or to resist detachment from the biomaterial surface. Physicochemical interactions between bacteria and material surfaces: Bacteria move to or are moved to a material surface through the effects of physical forces, such as

Brownian motion, van der Waals attraction forces, gravitational forces, surface electrostatic charge and hydrophobic interactions. These physical interactions are further classified as long-range and short-range interactions. Bacteria are transported to the surface by the so-called long-range interactions and upon closer contact, short-range interactions become more important. This implies a firmer adhesion of bacteria to a surface by the selective bridging function of bacterial surface polymeric structures, which include capsules, fimbriae or pili and slime. In fact, the functional part of these structures should be the adhesins, especially when the substrata are host tissues. Beyond phase two, certain bacterial strains are capable of forming a biofilm if provided with an appropriate supply of nutrients. During biofilm formation, bacteria secrete an exopolysaccharide layer that retains nutrients and protects the microorganisms from the immune response. A better understanding of the unique behavior of certain bacteria, the surface characteristics of the material and the relevant environment would make it possible for one to control the adhesion process by changing these factors. Katsikogianni et al 74 showed the effect of flow conditions on bacterial adhesion to several substrates, and in most material, except Diamond-like Carbon DLC coated poly vinyl chloride PVC deposited by Atom Beam A. Bacteria preferentially stick to rough surfaces and especially to irregularities that conform their shapes in order to maximize bacteria-surface contact area and probably protect themselves from shear forces. Bacteria possess membrane-bound proton pumps that extrude protons from the cytoplasm to generate a transmembrane electrochemical gradient, i. However, there are cellular processes which do not adapt to pH fluctuations so easily. One such process is the excretion of exopolymeric substances polysaccharides. Optimum pH for polysaccharide production depends on the individual species, but it is around pH 7 for most bacteria. The images obtained by SEM showed that the adhesion behavior of S. The quantitative adhesion number of adhering cells to glass surface showed that cells adhered strongly in the pH range 4 to 6 and weakly at highly acidic pH 2, pH 3 and alkaline conditions. The authors showed that when pH decreased from 7. Moreover, in this study they observed that HA and BCP ceramics did not have pores large enough to allow the internalization of staphylococci. Therefore, their anti-adherent properties seemed to improve when pH value decreased, suggesting that HA and BCP bioceramics are not compromised upon orthopedic use. The presence of antibiotics decreases bacterial adhesion depending on bacterial susceptibility and antibiotic concentration. The authors showed that the coatings, containing tobramycin, were effective against the growth of S. These results demonstrated the efficacy of the biomimetic coatings combined with tobramycin, to prevent local post-surgical infections in orthopedic surgery. The extracellular polymeric substance acts as a filter and conduit for nutrients and minerals that are channeled to interior cells and protects cells from potentially harmful agents, including antibiotics. However, they also saw that most of the antibiotic combinations that inhibited adherence did not have a profound effect on biofilm formation. In general, these results indicated that the effect on adherence inhibition was greater than the effect on inhibiting biofilm formation. The authors also realized that amoxicillin, erythromycin and levofloxacin were less active against biofilm-associated organisms as compared with their planktonic counterparts. Reducing bacterial adhesion during the initial 6 h period following implantation is particularly important to avoid device-associated infection. These authors showed that by adding low concentrations of linezolid or vancomycin before the bacteria could reach the surface, they were able to inhibit biofilm formation. However, if the application of the drug was delayed just by 6 h after initial adherence occurrence, the inhibition of biofilm formation was less effective. Materials with different functional groups change bacterial adhesion in a manner depending on material hydrophobicity and charge. Biomaterials surface roughness is another relevant property for the bacterial adhesion process, with the irregularities of the material surfaces normally promoting bacterial adhesion and biofilm accumulation whereas an ultra-smooth surface does not favor bacterial adhesion and biofilm accumulation. This was attributed mainly to the rougher surfaces associated with the N implanted specimens in comparison with the relatively smooth surface of the as-polished specimen. Therefore, it seems that roughness at a nanoscale can strongly influence initial attachment of bacteria, probably by providing the presence of a greater number of contact points. They observed greater P. Moreover, the ability of a nanostructured surface to influence irreversible adhesion, attachment of P.

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6: Bone Infections | Orthopedics | University of Colorado Denver

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7: Orthopaedic Infections

Hear the authors discuss Principles of Orthopedic Infection Management. Category: Orthopaedic Surgery There is really so much to learn in this essential, practical, keepsake guide to managing orthopedic infections.

8: Nuclear Medicine, the Painful Prosthetic Joint, and Orthopedic Infection

Staphylococcus comprises up to two-thirds of all pathogens in orthopedic implant infections and they are the principal causative agents of two major types of infection affecting bone: septic arthritis and osteomyelitis, which involve the inflammatory destruction of joint and bone. Bacterial adhesion is the first and most important step in implant infection.

9: Antiobiotic Prophylaxis to Prevent Surgical Site Infections - - American Family Physician

ORTHOPAEDIC INFECTIONS. Eugene Sherry, MD, MPH, FRACS. Soft Tissue Infections Cellulitis - An inflammatory infection of the subcutaneous tissues, usually due to staph or strep (and Haemophilus in children).

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Conclusion: The case for strategic ambiguity. Modern art and modernism Women and Justice 1980 round of demographic projections for Greater London Reference guide for essential oils higley The book, by M. Irwin. The subtle art of not giving a f framework Nikon d40 repair manual The dark side ofthe island Editors on editing gerald gross Blakes poems and prophecies Brain soup for the soul: gut-warming tales of success. How Hollywood projects foreign policy Hacienda Mar Monte, Pebble Beach Identifying and interpreting animal bones Ebook fallen lauren kate Californias Gold Rush General Certificate of Secondary Education Chemistry Functional chordate anatomy Army war reserves Super mario 3 manual The fiddler of the reels and other stories, 1888-1900 Recreating Ancient History Iron man manual daniel wallace Family-based study designs Audrey H. Schnell and John S. Witte The big picture : religion in America by the numbers, and then some Opportunities in telecommunications Construction Joint Ventures: 2001 Cumulative Supplement Anecdotes from history The quest for selling fulfillment Descargar el amargo don de la belleza Developing Societies in the Information Age The divine comedy : The inferno American cinema american culture chapter 2 Save tiger project in india Take charge of your diabetes Relevant other systemic disorders Allegory, legacy, and provisional endings. Issues in urban earthquake risk Buying selling a house in England and Wales