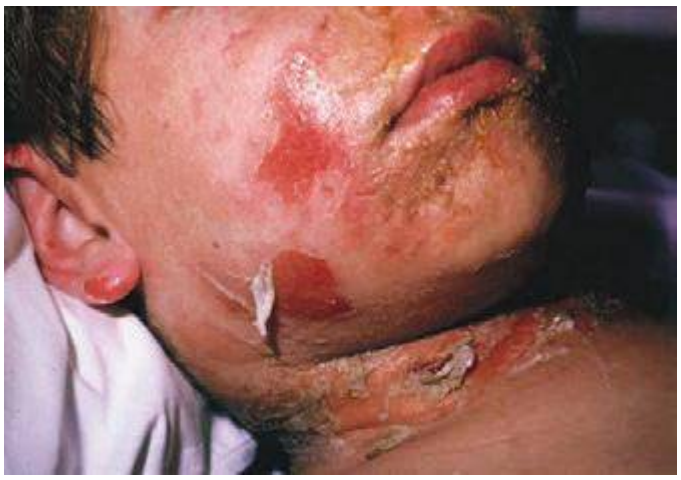

FIGURE 172-4 Evidence of staphylococcal scalded-skin syndrome in a 6-year-old boy. Nikolsky's sign, with separation of the superficial layer of the outer epidermal layer, is visible. *(Reprinted with permission from LA Schenfeld et al: N Engl J Med 342:1178, 2000. © 2000 Massachusetts Medical Society. All rights reserved.)*

successful at preventing the introduction and dissemination of MRSA in hospitals.

Decolonization strategies, using both universal and targeted approaches with topical agents (e.g., mupirocin) to eliminate nasal colonization and/or chlorhexidine to eliminate cutaneous colonization with *S. aureus*, have been successful in some clinical settings (e.g., intensive care units) where the risk of infection is high. An analysis of clinical trials suggests that there may also be a reduction in the incidence of postsurgical infections among persons who are nasally colonized with *S. aureus*.

"Bundling" (the application of selected medical interventions in a sequence of prescribed steps) has reduced rates of nosocomial infections related to such procedures as the insertion of intravenous catheters, in which staphylococci are among the most common pathogens (see Table 168-4). A number of immunization strategies to prevent *S. aureus* infections—both active (e.g., capsular polysaccharide–protein conjugate vaccine) and passive (e.g., clumping factor antibody)—have been investigated. However, none has been successful for either prophylaxis or therapy in clinical trials.

COAGULASE-NEGATIVE STAPHYLOCOCCAL INFECTIONS

Although considerably less virulent than *S. aureus*, CoNS are among the most common causes of prosthetic-device infections. Approximately half of the identified CoNS species have been associated with human infections. Of these species, *Staphylococcus epidermidis* is the most common human pathogen. This component of the normal human flora is found on the skin (where it is the most abundant bacterial species) as well as in the oropharynx and vagina. *Staphylococcus saprophyticus*, a novobiocin-resistant species, is a common pathogen in UTIs.

PATHOGENESIS

S. epidermidis is the CoNS species most often associated with prosthetic-device infections. Infection is a two-step process, with initial adhesion to the device followed by colonization. *S. epidermidis* is uniquely adapted to colonize these devices by its capacity to elaborate the extracellular polysaccharide (glycocalyx or slime) that facilitates formation of a protective biofilm on the device surface.

Implanted prosthetic material is rapidly coated with host serum or tissue constituents such as fibrinogen or fibronectin. These molecules serve as potential bridging ligands, facilitating initial bacterial attachment to the device surface. A number of staphylococcal surface-associated proteins, such as autolysin (AtlE), fibrinogen-binding protein, and accumulation-associated protein (AAP), may play a role in attachment to either modified or unmodified prosthetic surfaces. The polysaccharide intercellular adhesin facilitates subsequent staphylococcal colonization and accumulation on the device surface. In *S. epidermidis*, intercellular adhesin (*ica*) genes are more commonly found in strains associated with device infections than in strains associated with colonization of mucosal surfaces. Biofilm appears to act as a barrier protecting bacteria from host defense mechanisms as well as from antibiotics, while providing a suitable environment for bacterial survival. Poly-γ-DL-glutamic acid is secreted by *S. epidermidis* and provides protection against neutrophil phagocytosis.

Two additional staphylococcal species, *Staphylococcus lugdunensis* and *Staphylococcus schleiferi*, produce more serious infections (native-valve endocarditis and osteomyelitis) than do other CoNS. The basis for this enhanced virulence is not known, although both species appear to share more virulence determinants with *S. aureus* (e.g., clumping factor and lipase) than do other CoNS.

The capacity of *S. saprophyticus* to cause UTIs in young women appears to be related to its enhanced capacity to adhere to uroepithelial cells. A 160-kDa hemagglutinin/adhesin may contribute to this affinity.

DIAGNOSIS

Although the detection of CoNS at sites of infection or in the bloodstream is not difficult by standard microbiologic culture methods, interpretation of these results is frequently problematic. Because these organisms are present in large numbers on the skin, they often contaminate cultures. It has been estimated that only 10–25% of blood cultures positive for CoNS reflect true bacteremia. Similar problems arise with cultures obtained from other sites. Among the clinical findings suggestive of true bacteremia are fever, evidence of local infection (e.g., erythema or purulent drainage at the IV catheter site), leukocytosis, and systemic signs of sepsis. Laboratory findings suggestive of true bacteremia include multiple isolations of the same strain (i.e., the same species with the same antibiogram or a closely related DNA fingerprint) from separate cultures, growth of the strain within 48 h, and bacterial growth in both aerobic and anaerobic bottles.

CLINICAL SYNDROMES

CoNS cause a diverse array of prosthetic device–related infections, including those that involve prosthetic cardiac valves and joints, vascular grafts, intravascular devices, and CNS shunts. In all of these settings, the clinical presentation is similar. The signs of localized infection are often subtle, the rate of disease progression is slow, and the systemic findings are often limited. Signs of infection, such as purulent drainage, pain at the site, or loosening of prosthetic implants, are sometimes evident. Fever is frequently but not always present, and there may be mild leukocytosis. Acute-phase reactant levels, the erythrocyte sedimentation rate, and the C-reactive protein concentration may be elevated.

Infections that are not associated with prosthetic devices are infrequent, although native-valve endocarditis due to CoNS has accounted for ~5% of cases in some reviews. *S. lugdunensis* appears to be a more aggressive pathogen in this setting, causing greater mortality and rapid valvular destruction with abscess formation.

TREATMENT STAPHYLOCOCCAL INFECTIONS

GENERAL PRINCIPLES OF THERAPY

Surgical incision and drainage of all suppurative collections constitute the most important therapeutic intervention for staphylococcal infections. The emergence of MRSA in the community has increased the importance of culturing all collections in order to identify pathogens and to determine antimicrobial susceptibility. Successful therapy for prosthetic-device infections generally requires device removal. In situations in which removal is not possible or the infection is due to CoNS, an initial attempt at medical therapy without device removal may be warranted. Because of the well-recognized risk of complications associated with *S. aureus* bacteremia (e.g., endocarditis, metastatic foci of infection), therapy is generally prolonged (4–6 weeks) unless the patient is identified as being among those individuals who are at low risk for complications.