Infections from Body Piercing and Tattoos

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ABSTRACT The infectious complications of body piercing and tattooing are reviewed.

INTRODUCTION
Tattoos and body piercing have received more attention from the medical community in recent years. The increasing acceptance of tattoo and body piercing culture by mainstream society is evidenced by the popularity of numerous reality television shows, particularly those focused on tattooing. Temporary tattoos and body jewelry (without actual piercing) are popular decorative items for children as well. The term “body modification” or “body art” has been used to describe procedures that “enhance” a person’s appearance, whether permanent or temporary. These procedures include tattooing, body piercing, scarification, branding, and surgical modifications. For many people, body modification represents a form of artistic or creative expression that provides long-term enjoyment and thus can be considered a recreational pursuit. A positive effect of the increased interest in tattoos and body piercing has been the development of standardized protocols of infection control to protect the health and safety of both the client and the tattooist or piercer. Though the incidence of serious postprocedure complications appears to be low, a significant number of tattoos and body piercings are still performed by personnel who often do not follow appropriate precautions, thus increasing the possibility of both infectious and noninfectious complications.

PREVALENCE OF TATTOOS AND BODY PIERCINGS
The prevalence of tattoos and body piercing has certainly increased in recent decades, though previous studies may have been affected by underreporting of tattoos, because many older people still consider their own tattoos and piercings a sensitive topic. A visit to almost any high school or university in North America offers proof that body art is especially popular among adolescents and college students, with estimates of prevalence ranging from 13 to 23%. The prevalence of body piercing has been shown to range from 8 to 32%, with the highest prevalence noted in college students and young adults.

Though the arms, legs, and back are most commonly decorated, virtually any part of the body may be tattooed, including the palms and soles, eyelids, face, genitals, and tongue. The most common locations for tattoos differ between gender but generally are the arms, upper back, shoulders, and legs, with men more likely than women to have an exposed tattoo (89% versus 48%). In addition to the earlobe, common piercing sites include nonearlobe portions of the ear, the navel, oral sites, and the eyebrow.

TATTOOING
History
Tattooing has been performed since antiquity by numerous cultures. Tattoos have been noted on Egyptian mummies and the 5,000-year-old remains of Ötzi the
Iceman. The word “tattoo” may have been derived from a Polynesian word, tatau, meaning to “strike twice” and referring to the tattoo techniques used by the Polynesians. Captain James Cook was reported to refer to tatau after visiting the South Pacific. The modern word was subsequently derived and spread throughout Western cultures. Individual expression, decoration, storytelling, identification within a specific social group, and rites of passage are common reasons people have sought tattoos. More recently, tattooing has become a technique for application of permanent forms of makeup or as a permanent cosmetic camouflage of skin blemishes or scars. An apparent increase in the popularity of tattoos in Western cultures has been described since the 18th century, with members of the military and prison inmates commonly decorated with tattoos. Tattoos were also fashionable among high-society circles; Lady Randolph Churchill, Winston Churchill’s mother, started a trend for tattooing among her peers in the late 19th century. It is estimated that more than 20 million people presently have tattoos in the United States alone.

While generally considered to be decorative, tattooing has had a legitimate role in medical practice, including the use of injected dye to mark areas of the large intestine during colonoscopy for later reidentification. A short-lived practice using tattoos in the United States was Operation Tat-Type during 1951 and 1952. Fearing major blood shortages for transfusion during the Korean War, various government and medical groups considered the use of community-wide blood typing and the application of blood type tattoos on volunteers to allow for rapid identification of blood donor types. While only two communities adopted these proposals, thousands of adults and children received blood type tattoos. Ultimately, the program fell out of favor, though individuals from these communities may still bear these faded tattoos today.

Techniques
The tools used for tattooing have evolved over time, though the basic application techniques remain very similar. Pigment is deposited to a depth of 1 to 2 mm into the dermis by the use of various instruments. Traditional techniques involve using a sharp instrument to cut the surface of the skin, with the pigment pressed into the wound. Burning the skin followed by rubbing of pigment into the wound is a less commonly used technique. Traditional Samoan tattooing remains an important cultural rite of passage and is performed with a sharpened, serrated bone or shark’s tooth attached to the end of a long stick. The cutting edge or skin is saturated in ink, and the stick is tapped to create a shallow incision in the skin, into which the ink is deposited. Tattoo ink may be made from any number of pigmented substances, including ashes, oils, and synthetic dyes. Modern tattooing techniques accomplish the same goal, but with the aid of a motorized tattoo machine, which is less painful and allows for a more controlled application of ink and thus enables the artist to produce more intricate designs (Fig. 1). As skin is punctured, minor bleeding accompanies application of the tattoo. Over time the ink is trapped in fibroblasts within the dermis. After many years the ink may migrate deeper into the dermis and thus degrade the original detail of the tattoo. Commercial tattoo needles are available in numerous configurations which allow for a variety of functions from fine detail work to broader shading and filling (Fig. 2).

Tattoos applied in nonprofessional parlors remain common throughout the world and may represent an increased opportunity for infection. “Homemade” or “prison” tattoo techniques use any available needle or sharp object to puncture the skin. Instruments include sewing needles, pencil lead, staples, safety pins, guitar string, paper clips, and sharpened forks. Homemade ink (referred to as “smut” or “soot”) may be made from rust, ashes, toothpaste, ink from a pen, and other substances. Improvised needles may be attached to homemade tattoo guns constructed from any available small motor, such as those in cassette tape players, electric pencil sharpeners or electric grooming equipment. The term “scratchers” refers to people who have little training in tattoo application techniques. “Traumatic tattooing” refers to the introduction of any pigment, such as dirt, asphalt, or ink into a wound, leaving a permanent but accidental tattoo.

Professional tattoo artists follow strict infection control techniques and procedures to eliminate the risk of transmission of infections during the tattoo application. Sterilized needles are single-use only, and disposable barriers cover any parts of the equipment that may have potential exposure to body fluids. Ink is also single-use and obtained from commercial vendors. In the United States, licensing of tattoo parlors is conducted by local health departments.

Infectious Complications
The skin is an important physical barrier and immune mechanism. Disruption of the normal skin anatomy may predispose individuals to infectious complications. Numerous bacterial and fungal microorganisms colonize the surface of the skin. Coagulase-negative staphylococci and diphtheroids are common skin colonizers,
though one study suggests that *Pseudomonas* species may also be important colonizing bacteria in some people. Infectious disorders occurring after tattooing may be classified by the source of the infectious agent and may be separated accordingly into those due to endogenous and exogenous agents. Those due to endogenous agents represent diseases caused by normal flora following disruption of the skin’s normal barriers. These infections are not completely preventable, although the use of appropriate sterile techniques during tattoo application and proper aftercare of the new tattoo may serve to minimize the risk. Infections due to exogenous

**FIGURE 1** Professional tattoo machines. doi:10.1128/microbiolspec.IOL5-0016-2015.f1

**FIGURE 2** Professional tattoo needles. Seven count (upper needle) and two count (lower needle) configurations are shown. doi:10.1128/microbiolspec.IOL5-0016-2015.f2
agents are caused by inoculation of a microbe not present on the host initially and should typically be preventable if hygienic techniques are followed. Reuse of tattoo ink or needles, contamination of equipment between tattoo recipients, and use of contaminated body fluids during the tattoo process (e.g., saliva used to wet the needle) have all been implicated in transmission of pathogenic microbes. Viral hepatitis, tuberculosis, syphilis, and human immunodeficiency virus (HIV) disease are examples of infections following inoculation from an exogenous source. Pathogens such as *Staphylococcus aureus* may be responsible for either endogenous or exogenous infections, depending on the circumstances of the infection. Both endogenously and exogenously acquired infections have the potential to widely disseminate in the body via the bloodstream.

**Infectious Disorders Due to Endogenous Flora**

Streptococci and staphylococci are the most common bacterial causes of local infection at the tattoo site and may cause cellulitis, impetigo, erysipelas, or furunculosis. More invasive syndromes, including bacteremic illness, may follow these disorders.

Disseminated endogenous infection following tattooing has occurred, caused by both bacteria and fungi. Bacteremia typically complicates cellulitis and may result in metastatic infection. Polymicrobial sepsis with *Pseudomonas aeruginosa* and *Streptococcus pyogenes*, *S. aureus* epidural abscess, and necrotizing fasciitis following traditional Samoan tattooing have been reported. *S. aureus* aortic valve endocarditis following repeated tattooing occurred in a patient with a bicuspid aortic valve. *Candida albicans* endophthalmitis has been described for an asplenic individual with a recent tattoo application that required surgical drainage of the infected eye and long-term antifungal therapy with amphotericin B and fluconazole. There was no apparent local wound disease.

**Infectious Disorders Due to Exogenous Infections**

**Viral Hepatitis**

Among the exogenously acquired diseases associated with tattoos, viral hepatitis has probably been reported the most. The earliest reported outbreaks of acute hepatitis following tattooing occurred in military personnel who had received their tattoos at the same parlor, in which hygienic techniques were not employed. Both hepatitis B virus (HBV) and hepatitis C virus (HCV) are transmitted by transfusion of contaminated blood products, intravenous drug use, and occupational needlestick injuries. The risk of HBV transmission following needlestick with a hollow-bore needle is estimated to be between 2 and 40%, and the risk of HCV transmission is estimated to be between 3 and 10%. There are no precise data on specific risks for transmission of viral hepatitis during tattoo application.

During the last 50 years, numerous common-source outbreaks of acute hepatitis have been associated with recent tattooing. In some instances, the person applying the tattoo had an illness with jaundice in the months preceding the outbreaks. Patients developed acute hepatitis when contaminated needles were reused, inadequate techniques were employed to sterilize needles or dye, or an infected tattoo artist tested the needle on himself before using it on a client. Earlier cases of hepatitis were mostly likely due to HBV, though HCV could have been implicated in some.

The risk of transmission of viral hepatitis through tattooing has been extensively reviewed with varying findings. It is important to note that no outbreaks of HCV infection have been reported in the United States when tattooing (or piercing) is performed in a professional parlor. Association of HCV infection with tattooing appears to be strongest when application of the tattoo is performed in a nonprofessional setting, particularly prisons, where appropriate infection control practices and procedures are unlikely to be present. Tattoo application in prisons is particularly risky because equipment, ink, and needles may be reused between recipients, facilitating transmission of blood-borne pathogens. Other studies suggest that the presence of tattoos may be a surrogate marker for other risk-taking behavior that may also increase the risk of viral hepatitis acquisition. In a large study of college students in the United States there was no increased risk of HCV infection when the tattoo was performed in a professional setting. Similarly, a Dutch study of people with multiple tattoos, tattoo artists, and/or people with body piercings did not find an increased prevalence of HBV or HCV compared to the local population on seroprevalence. Clearly, the risk of transmitting viral hepatitis appears to be vastly increased for tattooing under nonsterile conditions coupled with a high prevalence of chronic viral hepatitis.

**HIV**

Concern about tattoo-associated HIV transmission is related to the known risks of transmitting HIV by needlestick injury. Though the risk of transmitting HIV is relatively low for a single needle puncture (approximately 0.1%), repeated punctures, as utilized during application of a tattoo, may increase the risk. Epidemi-
ological studies suggest that tattoo application is a risk factor for acquiring HIV in some prison populations and in military personnel who travel to high-prevalence countries. In contrast, a study of HIV infection of prisoners in Canada did not find tattooing to be a risk factor for HIV infection. Only one report of HIV transmission following tattooing has been published. In that instance, possible HIV transmission was reported for two prisoners who denied other risk factors (intravenous drug use, sex with other men, and prior blood transfusions) but who had extensive tattooing with a needle used to apply tattoos on other prisoners. Both were found to be positive for HIV during incarceration, presumably with prior documented negative HIV tests. The potential risk of HIV transmission via tattooing may be much higher in regions of the world where HIV prevalence is itself significantly greater. Genital tattooing is practiced by some cultural groups in central and western Africa and has been considered a possible mode of HIV transmission through reuse of tattoo needles. Clearly, a theoretical risk for transmitting HIV exists and should be considered by those who wish to have tattoos applied outside a professional setting where reuse of ink, needles, or other equipment between clients is likely.

Tuberculosis and atypical mycobacteria
Tuberculous cellulitis following cutaneous inoculation of *Mycobacterium tuberculosis* has been well described for more than a century. Historically, morticians and physicians who performed postmortem examinations on patients who died with active tuberculosis were prone to “prosector’s wart”—cutaneous tuberculosis at the site of a skin injury caused by instruments contaminated by *M. tuberculosis*. Similarly, inoculation tuberculosis following application of a tattoo has been documented since the late 19th century. In one instance, a child with pulmonary tuberculosis used ink mixed with his saliva and tattooed three friends who subsequently developed pustules, local adenopathy, and giant cells, as determined by skin biopsy at the site of the tattoos. Another report describes the development of presumed tuberculosis in a fresh tattoo contaminated by cow’s milk that may have come from an infected cow. The use of techniques considered nonhygienic by modern standards was apparently commonplace at the time of the reported infections of inoculation tuberculosis. Papular eruptions within a tattoo appear to be a commonly described manifestation of inoculation tuberculosis.

Inoculation leprosy, presumably from the use of contaminated needles, has been well described. *Mycobacterium leprae*, the agent of leprosy, is an important cause of infection in some parts of the world, particularly sub-Saharan Africa and Asia. Many of these cases describe the development of lepromatous skin lesions confined to a tattoo and developing years after the initial tattoo application. Presumably, a person with unrecognized leprosy was tattooed, and the needle was reused on subsequent individuals. The long latency period frequently described makes determining the exact source of the infection difficult in most cases, though descriptions of inoculation leprosy in American servicemen who received tattoos in countries with endemic leprosy and had no other risk factors support the hypothesis that tattooing transmitted the infection.

Nontuberculous mycobacteria species are ubiquitous in the environment and have caused infection in recently applied tattoos. *Mycobacterium chelonae* has been noted to cause outbreaks of cutaneous infections in a cluster of patients who received tattoos at the same tattoo parlor. The use of tattooing to apply permanent makeup, particularly of the eyebrows, has become popular in recent years, and outbreaks of infection due to *Mycobacterium haemophilum* from contaminated ink have occurred. Patients presented with ipsilateral suppurative lymphadenitis. Treatment required long-term antimicrobial therapy, and surgical debridement was necessary in some cases.

Syphilis (lues)
Both primary syphilis and secondary syphilis have been reported to occur following tattoo application. Syphilis is a sexually transmitted infection caused by the spirochete *Treponema pallidum*. It is spread from person to person by infected body fluids, including semen, vaginal secretions, saliva, and blood. Less commonly, kissing or other close contact with an active syphilitic lesion or direct inoculation may transmit infection. Primary syphilis is the first stage of infection, with the development of a painless papule at the site of inoculation occurring approximately 3 weeks after exposure. This lesion erodes and becomes indurated, forming the classic chancre. Chancre are usually encountered on or near the genitals, but they may appear almost anywhere depending on the site of inoculation. The chancre contains spirochetes and is infectious. Secondary syphilis may occur 2 to 8 weeks after the appearance of a chancre. This is a generalized illness with diffuse skin lesions and systemic symptoms and signs. The rash may be macular, papular, pustular, or a combination of lesions. Any organ system may be involved, leading to the protean manifestations of secondary syphilis.
If untreated, the rash will resolve over days to weeks. Chronic inflammation in an affected organ may lead to symptoms of tertiary syphilis (cardiovascular, neurological, and gumma late disease), usually occurring years after initial infection.

Primary syphilis at the site of a recently applied tattoo was described in the medical literature as early as 1889, where 12 army recruits all developed chancres consistent with syphilis at the site of recently applied tattoos. All of the recruits were tattooed by the same artist, who was determined to have syphilis and used his saliva to rewet the needle and ink or applied it directly to the tattoo site.

Lesions of secondary syphilis may localize within recently applied tattoos and may be due to chronic inflammation and decreased immune responses within the tattoo. Intriguingly, rashes of secondary syphilis have been noted to preferentially affect portions of some tattoos, with higher concentrations of skin lesions in areas with blue ink and the absence of lesions in areas with red pigment. This preference of the syphilis rash for blue-pigmented tattoos is due to the use of red cinnabar, or mercuric sulfide, in older formulations of red inks. Mercury compounds have been recognized for centuries to possess antiluetic activity and appear to prevent localization of disseminated treponemal disease in the red-pigmented areas, while the blue-pigmented areas are susceptible to the appearance of the rash of secondary syphilis.

Other infections
While *S. aureus* is usually considered an endogenous pathogen of tattoos, outbreaks of tattoo site infections where *S. aureus* appeared to be transmitted exogenously have occurred. Methicillin-resistant *S. aureus* (MRSA) was traditionally considered an important cause of infection in patients with significant health care exposures, such as hospitalization, residence in long-term care facilities, recent surgery, and dialysis, and in patients with indwelling devices. In recent years, MRSA infections have been recognized in people without any of the previously identified risk factors. These community-associated MRSA (CA-MRSA) infections commonly present as skin or skin structure infections and are due to unique MRSA strains that may have recently evolved. Outbreaks of CA-MRSA skin infections following tattooing were noted in 34 individuals from three states in the United States. None of the tattoos were applied in prison, but many were applied in a nonprofessional setting and without appropriate infection control practices. Some of the tattooists were noted to have skin infections on their hands at the time of the tattoo application, and homemade tattooing equipment was used in some cases. Manifestations of CA-MRSA infection included pustules, cellulitis, and abscesses in or adjacent to the recently applied tattoo, and some lesions required surgical drainage. All of the bacteria available for testing from patients were noted to be the USA300 genotype, the most common strain of CA-MRSA associated with skin and soft-tissue infections.

Tetanus, a disease caused in toxins produced by *Clostridium tetani*, has followed tattooing in Maori individuals in New Zealand as well as in people in the United States. Of course, the risk of tetanus is inversely proportional to the level of protective antibody associated with prior immunization. In addition to bacterial diseases, a variety of other pathogens have been reported to cause apparent exogenous infection of tattoos including viruses and fungi. Transmission of papillomavirus from contaminated ink or needles has resulted in the appearance of warts at the site of recently applied tattoos. Vaccinia has also been reported to occur near a recently applied tattoo and may have represented inoculation of virus.

Tattoo-related fungal infections have also been reported. Sporotrichosis, typically a lymphocutaneous infection caused by the fungus *Sporothrix schenckii*, was described to occur starting at the site of a tattoo recently applied using traditional Samoan techniques. The infection was likely due to inoculation of the skin with *S. schenckii* at the time of tattooing, and cutaneous nodules persisted for 6 years until definitively treated with itraconazole. Invasive mold disease with members of the zygomycete family usually occurs in immunocompromised individuals but also may occur in others. A subcutaneous infection with *Saksenaea vasiformis* at the site of a tattoo applied 7 years previously has been described to occur in an immunocompetent individual, though it is unclear whether the mold infection was inoculated at the time of tattoo application or acquired more recently.

**BODY PIERCING**
Body piercing has gained popularity recently in developed countries but has been performed in primitive cultures for thousands of years, often as a rite of passage or associated with religious ceremonies. Piercing of the male genitals was described in the 4th-century Indian text the *Kama Sutra* as follows: “In southern countries,
the penis is pierced during childhood, just as one pierces the ears. Purists of body piercing often do not consider earlobe piercings true body piercings and prefer to consider piercings of the face, navel, nipples, and genitals to be true body piercings. More recently, “surface piercings,” where jewelry is embedded in almost any surface of the body (especially the chest, neck, or arms), and implanting of jewelry or other foreign material (e.g., plastic beads, metal, and even natural pearls) into the subcutaneous tissue has become popular. Jewelry has even been inserted into the conjunctiva of the eye in The Netherlands, a controversial procedure that appears to risk serious complications. However, we were unable to find reports of infectious complications from these procedures. Since any body piercing may result in various complications, for purposes of this discussion we define body piercing as the use of any adornments that penetrate the skin or other structures of the human body. We include earlobe piercings in this definition.

**Body Piercing Techniques**
Specific techniques of body piercing vary depending on the site of the piercing but are generally similar. Most piercings are accomplished using a sharp, hollow needle designed for this purpose. The site to be pierced is usually held in place by a surgical clamp (Pennington or Foerster clamp), through which the needle is pushed by hand into a cork or rubber stopper. The needle is typically 14 or 16 gauge (though larger sizes are available) and is made of stainless steel. An open end of the jewelry is introduced into the rear blunt end of the piercing needle and pulled through the opening made by the needle, and the needle and stopper are removed. As with tattooing, nonprofessional piercing is common using available household equipment and improvised techniques.

Modern body jewelry implanted during piercing is fabricated of stainless steel, titanium, gold, niobium, or acrylic. Nickel-containing alloys are not recommended due to the risk of hypersensitivity. Frequently, a barbell-shaped device with two threaded beads at the ends or an open loop closed with a bead is used as the initial choice of jewelry. However, many styles of jewelry exist, with unique shapes being used with increasing frequency. Traditional jewelry used by cultures in developing countries where body piercing is common includes items made of bone, wood, metal, shells, or feather quills.

**General Infectious Complications**
The risk of infection itself and the precise types of infectious disorders that follow body piercing depend on the site of the piercing, extent of hygienic techniques used during the procedure, experience of the person performing the piercing, general host defenses of the individual receiving the piercing, and aftercare of the pierced site. Healing time, generally a function of blood supply and tissue integrity, varies greatly with body location and is an important factor in the risk of infection. As with tattooing, infections associated with body piercing may be generally classified as either endogenous or exogenous depending on the suspected source of infection. Local inflammatory reactions must be distinguished from early local infections and may be due to direct mechanical irritation, allergic reactions to the metal, or granulomatous foreign-body reactions. Local cellulitis at the site of new piercings is the most common infectious complication, with an overall estimated prevalence ranging from 10 to 30%. The most common sites where local infections have been described to occur include the navel, ear, nose, and nipple. Less commonly, piercings of the tongue, genitals, and other sites appear to be complicated by infectious disorders. Cellulitis, characterized by redness, swelling, pain, and purulent drainage from the piercing site, is most commonly caused by *S. aureus*, group A streptococci, and aerobic Gram-negative bacilli, particularly *Pseudomonas* species. Table 1 summarizes the infectious disorders associated with body piercing. Rarely, malignancy may occur at the site of piercing, as in the case of a patient who developed squamous cell carcinoma at the site of a urethral piercing (a “Prince Albert” piercing), and must be differentiated from a local infectious process.

**Endogenously Acquired Infectious Complications by Site of Piercing**

**Ears**
The ear remains the most commonly pierced site; as many as 80 to 90% of women in North America have at least one ear piercing, and a growing number of men report having had their ears pierced. In addition to the earlobe, the cartilaginous portions of the ear, including the tragus, antitragus, helix, and antihelix, may be pierced. In addition, “flesh tunnels,” stretched earlobe piercings, are common in many indigenous cultures and have become quite popular in contemporary piercing practices. Techniques of ear piercing include the use of a piercing gun, which uses pressure to push the earring post through the earlobe, and use of a needle in the earlobe or cartilage to create a hole through which jewelry is placed. Piercing guns are apparently difficult to thoroughly disinfect. Local infections of the earlobe are most commonly caused by *S. aureus* and group A
TABLE 1 Overview of infectious complications of body piercing

<table>
<thead>
<tr>
<th>Site</th>
<th>Infectious complication</th>
<th>Associated pathogen(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Local infections, cellulitis, hepatitis, HIV</td>
<td>Staphylococci, streptococci, HBV, HCV</td>
</tr>
<tr>
<td>Ear</td>
<td>Chondritis, bacteremia, hepatic abscess, meningitis, osteomyelitis, toxic shock syndrome, glomerulonephritis, infective endocarditis, tetanus, tuberculosis</td>
<td>Staphylococcus aureus, group A streptococci, Pseudomonas species</td>
</tr>
<tr>
<td>Oral</td>
<td>Glossitis, abscess, Ludwig's angina, Lemierre's syndrome, cerebellar abscess, IE, tetanus, warts</td>
<td>Oral flora, Haemophilus aphrophilus, Neisseria mucosa, S. aureus, Gemella morbillorum, papillomavirus</td>
</tr>
<tr>
<td>Nose</td>
<td>IE</td>
<td>S. aureus</td>
</tr>
<tr>
<td>Nipple</td>
<td>Mastitis, breast abscess, IE, infected prosthetic breast implants</td>
<td>Staphylococci, streptococci, Mycobacterium abscessus, Mycobacterium fortuitum, Prevotella melaninogenica, Gordonia terrae</td>
</tr>
<tr>
<td>Navel</td>
<td>Cellulitis, IE, tetanus</td>
<td>S. aureus, viridans group streptococci</td>
</tr>
<tr>
<td>Genital</td>
<td>Warts, sexually transmitted infections</td>
<td>Papillomavirus</td>
</tr>
</tbody>
</table>

Abbreviations: HBV, hepatitis B virus; HCV, hepatitis C virus; IE, infective endocarditis.

A history of poorly controlled diabetes mellitus was noted in a woman who developed local inflammation and local infection of the ears, suggesting that conditions that compromise the immune system or wound healing may lead to complications following even typical earlobe piercings. Cellulitis and erysipelas at ear piercing sites have been well recognized since the 19th century. Chondritis following piercing of the cartilaginous portions of the ear is usually due to Pseudomonas species. The decreased vascularity of ear cartilage compared to that of the soft tissue of the earlobe increases the risk of bacterial infection at that location.

As in other situations, cellulitis may occasionally be complicated by bacteremia. The occurrence of severe disseminated S. aureus infection in children following recent earlobe piercings or subacutely infected earlobe piercing sites has been well described. Hepatic abscesses complicated one case of bacteremia, another was complicated by osteomyelitis, and a third was complicated by meningitis. In addition, spondylitis has also been associated with infection following ear piercing. Immune-mediated disease following ear piercing may occur, as in the case of poststreptococcal glomerulonephritis occurring in a boy who had recently pierced his own ear and developed group A streptococcal infection of the earlobe, and a case of toxic shock syndrome following earlobe piercing. Infective endocarditis (IE) has followed ear piercing in several patients, including viridans group streptococcal aortic valve endocarditis complicated by a Gerbode ventricular septal defect in an otherwise healthy 15-year-old boy.

Oral piercings

Infections reported following oral soft tissue piercings have a broad variety of microbiological etiologies reflecting the many commensal organisms in the oral cavity. Oral piercing sites include the tongue, lip, cheek, and rarely, the uvula. Metastatic infectious complications have been described most frequently for tongue piercings. This discussion focuses on tongue piercings, because the vast majority of reported infections involve complications of this procedure. However, Lemierre’s disease with external jugular vein thrombosis and septic pulmonary emboli was tenuously associated with a lip piercing, occurring 6 weeks after the piercing. Lemierre’s disease is a severe oropharyngeal infection caused by Fusobacterium necrophorum and may be complicated by jugular vein thrombosis and metastatic spread of infection to the lung, liver, joints, and other sites.

Tongue piercings may be horizontal or vertical through the tongue or through the frenulum beneath the tongue. Despite the rich microbiological environment of the mouth, infections of tongue piercings remain uncommon, probably due to the rich vascularity of the tongue and the related rapid healing time for tongue injuries. The choice of jewelry material may also influence the risk for infection because some materials (e.g., steel or titanium) may promote the development of biofilms more than other materials (e.g., polytetrafluoroethylene or polypropylene). Local inflammation following piercing is expected, with significant swelling and tenderness of the tongue, but this usually resolves in a few days to several weeks. Most tongue infections can be prevented with appropriate aftercare, usually involving regular use of antiseptic mouthwash during the initial healing period. Persistent swelling, tenderness, and pain may indicate glossitis, a local soft tissue infection of the tongue. If severe, glossitis justifies removal of the jewelry and systemic antimicrobial therapy.

Development of a lingual abscess requiring surgical drainage has been reported to occur in an adolescent who attempted to pierce his tongue. Ludwig’s angina, a...
rapidly spreading cellulitis involving the submandibular and sublingual spaces, has also been reported to occur 4 days after placement of a tongue piercing. Bacteremia complicating tongue piercing may result in metastatic disease as well. A cerebellar abscess in a previously healthy woman who had a tongue piercing 4 weeks earlier has been reported. It seems that after the piercing, the patient had a self-limiting infection at the site, with purulent discharge. Headache, nausea, vomiting, and vertigo characterized the patient’s illness, and the abscess required surgical drainage and long-term antimicrobial therapy. Cultures of the abscess revealed a polymicrobial infection with viridans group streptococci, Peptostreptococcus micros, Actinomyces species, and Eikenella corrodens. The bacteria cultured were consistent with an oral source of infection. No other infectious sources or predispositions could be found in this patient. Streptococcus intermedius and C. albicans, both also potential oral commensals, have caused brain abscess and vertebral discitis, respectively.

IE associated with tongue piercing has been reported for at least seven individuals (Table 2). Only one of the patients who developed IE after tongue piercing had a known predisposing cardiac valve defect. The microbiology of these infections was diverse, likely representing the flora of the oral cavity, and included streptococci, S. aureus, Neisseria mucosa, and Haemophilus aphrophilus. One individual developed mitral valve IE 3 days after replacing her tongue jewelry with (apparently) contaminated jewelry from a friend, highlighting the importance of not sharing body jewelry, especially immediately after a piercing has been placed.

Other facial piercings
Eyebrow, “antieyebrow” (piercings lateral to the eye or on the upper cheek below the eye), bridge, and nasal piercings are also common. Nasal piercing sites include the nostril or septum. In one reported complication of nasal piercing, S. aureus mitral valve IE occurred in a 14-year-old girl without known prior cardiac abnormalities. S. aureus was cultured from the nose and was the possible source of infection.

Nipples
In addition to cellulitis alone, infection may extend more deeply and has been noted to cause mastitis in both men

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**TABLE 2** Endocarditis associated with tattooing and body piercing

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Organism</th>
<th>Valve affected</th>
<th>Predisposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tattooing</td>
<td><em>Staphylococcus aureus</em></td>
<td>Aortic</td>
<td>Bicuspid valve</td>
</tr>
<tr>
<td>Ear piercing</td>
<td>Viridans group streptococci</td>
<td>Aortic</td>
<td>None</td>
</tr>
<tr>
<td>Ear piercing</td>
<td><em>S. aureus</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
<td>Ear piercing</td>
<td><em>S. aureus</em></td>
<td>Tricuspid</td>
<td>None</td>
</tr>
<tr>
<td>Ear piercing</td>
<td><em>S. aureus</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
<td>Ear piercing</td>
<td><em>S. aureus</em></td>
<td>Homograft conduit</td>
<td>Tetralogy of Fallot</td>
</tr>
<tr>
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<td><em>S. aureus</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
<td>Eyebrow piercing</td>
<td><em>S. aureus</em></td>
<td>Tricuspid, pacemaker lead</td>
<td>Implantable pacemaker</td>
</tr>
<tr>
<td>Nasal piercing</td>
<td><em>S. aureus</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
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<td><em>S. aureus</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
<td>Lip piercing</td>
<td><em>Haemophilus parainfluenzae</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
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<td><em>Gemella morbillorum</em></td>
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<td>None</td>
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<tr>
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<td><em>Haemophilus aphrophilus</em></td>
<td>Aortic</td>
<td>Bicuspid valve, repaired aortic stenosis (valvuloplasty)</td>
</tr>
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<td><em>Neisseria mucosa</em></td>
<td>Mitral</td>
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</tr>
<tr>
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<td><em>S. aureus</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
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<td>Viridans group streptococci</td>
<td>Aortic</td>
<td>None</td>
</tr>
<tr>
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<td>Alpha-hemolytic streptococci</td>
<td>Mitral</td>
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<td><em>S. aureus</em></td>
<td>Mitral</td>
<td>None</td>
</tr>
<tr>
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<td><em>Streptococcus constellatus</em></td>
<td>Aortic</td>
<td>None</td>
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<td>Nipple piercing</td>
<td><em>Staphylococcus epidermidis</em></td>
<td>Aortic</td>
<td>Bicuspid valve, repaired aortic coarctation</td>
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<td>Myocardial septum</td>
<td>Ventricular septal defect</td>
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<td>Tricuspid</td>
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<tr>
<td>Navel piercing</td>
<td>Culture negative</td>
<td>Tricuspid</td>
<td>None</td>
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and women after nipple piercing. Mastitis cases due to coagulase-negative staphylococci, group B streptococci, and microaerophilic staphylococci following nipple piercing have been described. Serious complications following nipple piercing include the development of *Staphylococcus epidermidis* aortic valve IE in a 24-year-old man with a bicuspid aortic valve and corrected aortic coarctation, and fatal toxic shock syndrome in a healthy 17-year-old girl. An unusual complication of nipple piercing is breast implant infection associated with preceding cellulitis at the piercing site. Implant infection has been reported for both a female patient with silicone breast implants and a male patient with solid pectoral implants who developed group A streptococcal infection after nipple piercing. Even more intriguing may be an association between nipple piercing, subsequent infection of the piercing site, and the development of hyperprolactinemia. Hyperprolactinemia was exacerbated following nipple piercing and local infection in a man who had previously well-controlled hyperprolactinemia and was seen in a woman with no prior endocrine disorders following nipple piercing and local infection. It is possible that nipple stimulation by either infection, nipple jewelry, or both may lead to excessive prolactin secretion and could lead to galactorrhea, a disorder of inappropriate lactation.

**Navel**

The navel is probably the most common site of body piercing after the ear. It is also the most likely body piercing site to experience a prolonged healing time (several months) and to be associated with infectious complications. Navel piercings may be performed through the subcutaneous tissue on any side of the navel. It should never include the umbilical remnant, which is more exposed in people with extroverted navels, because infection in this tissue may lead to intra-abdominal infection. Prolonged healing at the navel may be due to the presence of tight clothing irritating the pierced tissue and the presence of a persistent moist environment. There are few reports describing the precise bacterial etiology of cellulitis complicating navel piercing, but one may assume that staphylococci and streptococci are frequently implicated. A serious complication of navel piercing occurred in a 13-year-old girl with corrected D-transposition of the great arteries who developed *S. aureus* IE after she pierced her own navel. The patient did not take prophylactic antibiotics before the piercing, and a self-limiting local infection reportedly developed 2 days after the piercing, followed in 1 month by symptoms of IE. Several other cases of IE after navel piercing have also been reported (Table 2). Tetanus has been reported to occur in a 27-year-old woman with a remote history of tetanus vaccination who performed a navel piercing on herself and developed facial pain and trismus 10 days later.

**Genital piercings**

Anatomical sites for male and female genital piercings are extremely diverse, and no part of the genitalia has been spared. “Traditional” male genital piercings include the Prince Albert piercing (a ring passes through the urethra and ventral surface of the penis), dydoe (piercing the coronal ridge of the glans), ampallang (horizontal bar through the glans), apadravya (vertical piercing through the glans), hafada (piercing of the lateral scrotal tissue), guiche (piercing the perineal tissue between the scrotum and anus), frenulum piercing, and foreskin piercing. “Traditional” female genital piercings include piercings of the labia majora or minora, clitoris, and clitoral hood as well as the fourchette (a female version of the guiche piercing). As with other piercings, the popularity of body piercings has spawned numerous other variations on the traditional piercings.

Serious infectious complications of genital piercings do not appear to be common. Infectious complications usually appear to reflect the local flora of the perineum or acquisition of disease through sexual activity. Aerobic Gram-negative bacilli, such as *Escherichia coli*, and other enteric bacteria that are common causes of genitourinary infections are also likely causes of genital piercing infections, in addition to skin flora bacteria.

Recurrent genital warts have been noted at the site of a new penile frenulum piercing. The recent piercing caused local tissue damage that may have predisposed the patient to the recurrent papillomavirus infection.

**Exogenously Acquired Diseases Associated with Body Piercing**

As discussed above, studies have attempted to define an association between body piercing and viral hepatitis, with the general consensus that body piercing is a risk factor for the spread of hepatitis B and C if aseptic techniques are not followed and if the equipment used is contaminated by blood from prior infected clients. Sharing of contaminated body jewelry has also been implicated in the transmission of viral hepatitis.

Mycobacterial infections appear to be an infrequent cause of infection following body piercing, with *Mycobacterium abscessus* and *Mycobacterium fortuitum* reported to cause breast abscess or mastitis after nipple piercing. Other bacteria that have complicated nipple piercings include *Prevotella melaninogenica* and *Gordonia*
Infections from Body Piercing and Tattoos

**terrace.** Tetanus has been most frequently associated with ear piercing. A single case of cephalic tetanus following tongue piercing has been described, manifesting as jaw pain, trismus, dysarthria, and flu-like symptoms. Mold infections following piercing appear to be uncommon. Invasive aspergillosis of the earlobe that developed after a recent ear piercing was reported in a 15-year-old girl with acute lymphocytic leukemia and neutropenia.

Infection of the piercing recipient by HIV has been postulated but not well documented. A single case is described of a male with multiple documented sero-negative tests for HIV antibody who subsequently sero-converted. During the year prior to seroconversion, he had multiple body piercings performed in several different countries. He also had three male sexual partners. While it is possible that the patient acquired HIV during a body piercing procedure, it is difficult to prove. Regardless, the possibility of HIV transmission exists if contaminated needles are reused.

Inoculation of infectious agents at the time of piercing or during the healing period has also been reported to cause disease. Primary tuberculosis of the earlobe has been reported for an infant following ear piercing by her mother, who had active pulmonary tuberculosis and may have moistened the piercing needle with her saliva. Growth of warts due to human papillomavirus at the site of a new tongue piercing has been described, particularly following unprotected oral sex with a partner with genital warts. Piercing-associated warts usually do not resolve spontaneously and may require excision.

Sexually transmitted diseases are of particular concern for individuals with genital piercings. Unprotected sex with an unhealed piercing poses increased risk of transmission of many sexually transmitted diseases, including HIV, herpes simplex, syphilis, and gonorrhea. Even after a piercing is healed, it may cause mechanical irritation to mucous membranes and decrease the local barriers to transmission of viruses or bacteria.

**PREVENTION OF INFECTIONS**

Prevention of infectious complications following tattooing or body piercing begins with the person performing the procedure. In recent years, most states in the United States, as well as many Western countries, have developed specific legislation that requires tattoo and piercing parlors to follow strict hygiene and infection control policies. Usually, local public health departments (county and state) are responsible for ensuring that safe and sanitary practices are followed. In addition, professional piercing and tattooing associations have had some self-regulated infection control practices within their own industry. Generally, state laws mandate the use of single-use needles; sterilization of nondisposable equipment, needles, and jewelry prior to use; and appropriate environmental disinfection guidelines. Piercing guns are not recommended, nor are home piercing kits. People not experienced in appropriate tattooing or body piercing techniques, as well as those with equipment and jewelry that have not been properly sterilized, should not perform tattooing or body piercing. Professional establishments should provide appropriate aftercare instructions depending on the site of the piercing. For people with genital piercings, sexual activity should be avoided during the healing period. The Association of Professional Piercers (http://www.safepiercing.org) provides general aftercare recommendations and precautions for various body piercings.

**TREATMENT OF INFECTIONS ASSOCIATED WITH TATTOOING AND BODY PIERCING**

Most cases of local infection following body piercing may be managed with local care (mild antiseptics or irrigation with saline solution). Removal of jewelry is not advocated if a local infection occurs, because it may result in a loculated infection in the pierced tract. Rather, the jewelry maintains a patent drainage site, aiding in healing of the infection. If the infection progresses, however, removal of the jewelry may be necessary, especially if a loculated abscess is already present, which would require irrigation and debridement. Systemic antibiotics may be indicated for local infections that do not resolve or in the case of associated signs and symptoms of systemic infectious disease, such as fever or chills. Antibiotic choices should take into account the role of the local flora at a specific piercing site. Infected oral piercings should be treated with antimicrobials with broad aerobic and anaerobic coverage. Genital piercings are predisposed to infections caused by aerobic Gram-negative bacilli, especially the *Enterobacteriaceae*, as well as anaerobes, staphylococci, and streptococci. Antipseudomonal antimicrobials should be considered for treatment of auricular chondritis. All body piercing–associated infections should have adequate antimicrobial coverage for staphylococci and streptococci. For complicated infections (metastatic infection, bacteremia, and deep abscesses), blood cultures should be performed, and in the case of abscesses, operative cultures at the time of drainage should be performed to guide...
antimicrobial therapy. An experienced tattoo artist should generally evaluate local infection of a recently applied tattoo. If cellulitis or metastatic or systemic infection is suspected, evaluation by a physician and systemic antibiotics are warranted.

**PRECAUTIONS FOR SPECIAL POPULATIONS**

Certain medical conditions may increase the risk of infectious complications of body piercing, especially for patients with congenital cardiac abnormalities, cardiac valvular disease, and immunologic disorders that predispose them to bacterial infections. The incidence of bacteremia following tattooing or body piercing is unknown. Bacteremia would be expected to place individuals with valvular or congenital heart disease at risk for IE. Of the 26 reported cases of IE that have been associated with body piercing or tattooing, 7 occurred in people with cardiac predispositions (Table 2). Symptoms of infection occurred in as little as 4 days to as long as several years after the procedure. Patients with predisposing cardiac abnormalities should be made aware of the risk of serious infection, especially IE, and some clinicians recommend avoidance of tattoos and body piercing altogether or the use of prophylactic antibiotics. Though there are no specific guidelines for the prevention of IE in the setting of tattooing or body piercings, guidelines for the prevention of IE published by the American Heart Association may be useful, particularly in reference to oral piercings. Since perforation of the oral mucosa is considered a dental procedure, it may be reasonable to extrapolate the recommendations for prevention of IE in people undergoing dental procedures.

The cardiac conditions with the highest risk of endocarditis, for which antibiotic prophylaxis is recommended, include the presence of a prosthetic heart valve, previous IE, cardiac transplantation with development of cardiac valvulopathy, and specific congenital heart disease (unrepaired cyanotic congenital heart disease, completely repaired congenital heart defect with prosthetic material or device during the first 6 months after the procedure, and repaired congenital heart disease with residual defects at or adjacent to the site of prosthesis that prevent endothelialization). While tattoos generally heal rapidly after application, body piercings may take weeks or longer to heal depending on the site of the piercing, and the short duration of benefit provided by antimicrobial prophylaxis may be inadequate to reduce the risk of infection during the entire healing period. It may be advisable that patients with the highest-risk cardiac conditions consider avoiding body modifications altogether. Similarly, patients who are predisposed to infections due to immunosuppression, immunocompromising disorders, or poorly controlled diabetes mellitus or those with chronic skin disorders should be aware of the risk of serious infection and should consider avoiding these procedures.

**SUMMARY**

Medical practitioners and the general public should be aware of the potential risks of infection associated with tattooing and body piercing. Early recognition of infection following tattooing or body piercing is important to prevent potential complications, but such infections can be difficult to appreciate because most health care professionals are unfamiliar with the clinical characteristics of infections associated with these procedures. More recently, the popularity of these procedures has led to greater awareness and application of hygienic techniques and to use of sterile equipment, hopefully reducing the risk of transmitting blood-borne infections. In addition, public health departments have helped to regulate safe practices and procedures. Most infections seen today are due to endogenously acquired microorganisms, which may contaminate the healing tissue. People interested in getting a tattoo or body piercing should seek professional artists who follow established hygienic techniques. The Association for Professional Piercers (http://www.safepiercing.org) and the Alliance of Professional Tattooists (http://www.safe-tattoos.com) are resources that provide information on reputable tattooists and piercers. Certain populations, especially those with significant immunocompromise, skin disorders, or predisposing cardiac disease, should consider the infectious risks of tattooing and body piercing and take the appropriate precautions, discuss the procedure with their health care providers, or avoid these procedures altogether.

**PRACTICAL TIPS**

- Tattooing and body piercing should be performed only by professional practitioners who are licensed by state or local health departments.
- People with chronic skin conditions, congenital or valvular heart disease, diabetes mellitus, or other immunocompromising conditions should thoroughly discuss the risks of tattooing or body piercing with a medical professional.
People undergoing these procedures should follow the aftercare instructions for a new tattoo or body piercing provided by a professional tattooist or piercer.

If you suspect an infection is present, have the site evaluated by the tattooist or piercer.

A medical professional should immediately evaluate systemic symptoms of infection, such as fevers or chills, or infections that are not responding to local wound care.

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RECOMMENDED READINGS


