Infective complications of tattooing and skin piercing

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Summary
Body piercing appears to be gaining popularity and social acceptance. With the increase in the number of piercings and tattoos, it is likely that health care providers may see an increase in the complications resulting from these piercings. These may include the transmission of hepatitis viruses and bacteria at the time of the piercing or in the course of wound care. We review the infectious complications that have resulted from body piercing and tattooing that has been documented in the medical literature.

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Introduction

Tattoo {tat-too} noun [1]
A permanent picture, design, or other markings made on the skin by pricking it with a sharp implement and staining it with indelible dye.

Skin piercing {peersing} adjective [2]
The practice of piercing holes in parts of the body so that rings or studs can be inserted for cultural, fashion, or sexual purposes (skin piercing = body piercing).

Throughout history tattooing and body piercing has been practiced by many cultures. The body of a 4000-year-old tattooed man was discovered in a glacier on the Austrian border in 1992. Egyptians in the period from 4000 to 2000 B.C., identified tattooing with fertility and nobility. In the late nineteenth century, tattooed royalty in England and European countries were fashionable. Lady Randolph (Winston Churchill’s mother) had a snake tattooed around her wrist [3].

Like tattooing, body piercing has been practiced in many cultures for many centuries. Body piercing was often identified with royalty and portrayed courage and virility. Egyptian Pharaohs pierced their navels as a right of passage [4]. Roman soldiers pierced their nipples as a symbol of manhood. Mayans pierced their tongues as a spiritual ritual, and both sexes of Victorian royalty chose nipple and genital piercing.

In the last decade, tattooing and body piercing have become both fashionable and commonplace procedures easily available in the high street. Body piercing has advanced to a level way beyond superficial piercing. In extreme cases it involves complex surgery [5]. The art of tattooing and body piercing in the U.K. is not regulated (except London), and there is growing concern at the number and severity of injuries sustained from commercial tattooists and body piercers. In a recent survey in the United Kingdom, 95% of general practitioners in Rochdale have had to deal with medical complications arising from body piercing [6].

Infectious complications of tattoos

Bacterial infections
Local and systemic infections
Severe local infections, involving gangrene, amputation, and even death, have occurred following tattooing [7]. These infections are hardly surprising, since in the nineteenth century tattooists used substances such as saliva, urine, dirty water, and tobacco juice topically during and after the tattooing process. Today, local infections may occur in tattoos applied by professionals but may occur more often when proper wound care is not carried out. Local infections that do arise are most commonly superficial pyodermas, including impetigo, erysipelas, furunculosis, and ecthyma. These infections have been reported to occur more commonly with home made tattoos [8].

Syphilis
In the latter half of the nineteenth century, syphilis was reported to be transmitted by tattoos [9]. In the majority of cases, the tattooist either had oral syphilitic lesions or had developed primary syphilis a few months before the tattooings. A striking finding was that many tattooists working with a single needle, often held the needle in their mouths between applications to suck out the residue of the pigment or to re-wet the needle before dipping it into the dried pigment prior to skin puncturing [7,9]. It is no wonder that so many people were infected with syphilis as a result of receiving tattoos.
Mycobacteria infections
Cutaneous tuberculosis usually occurs following infection with *Mycobacterium tuberculosis* from an exogenous source or by endogenous spread from another site. Cutaneous tuberculosis in a tattoo has been reported after a tattooist with advanced pulmonary tuberculosis, mixed his saliva with the ink in the tattoo process [10]. Several cases of leprosy first appearing in tattoos have been reported but the exact method of transmission was not completely understood and remains somewhat controversial [11].

Other bacterial infections
Chancroid and tetanus have also been reported to occur from tattooing [7]. There has also been one case report of a patient who developed bacterial endocarditis following extensive tattooing [12].

Viral infections
Warts
Verruca vulgaris, verruca plana, unspecified warts, and warty growths have all been reported to have occurred in tattooed lines [13—15].

Vaccinia
One case of vaccinia in proximity to a recently applied tattoo was reported that resulted in scarring and peeling of the surrounding skin [16].

Pox viral infections
There has been one reported case of Molluscum contagiosum as a complication of tattooing [16].

Herpes viruses
Herpes simplex and zoster have also been reported to have been transmitted by tattooing [16].

Viral hepatitis
The most well-documented infection transmitted by tattoos in the twentieth century is hepatitis [7,16—20]. Hepatitis infections include the viral subclasses of A—E, and G [21]. The most important transmissible forms of the virus in relation to tattooing are B and C [16]. Up to 5% of adult patients infected with the hepatitis B virus and up to 80% of those infected with the hepatitis C virus become chronic carriers [21]. Up to 20% of these infected individuals will go on to die from complications of liver disease such as cirrhosis and 1—2% will die of hepatocellular carcinoma [22,23].

Hepatitis C is actually more common than hepatitis B but is not as well known. It is regarded as being a moderately transmissible disease with no known cure or specific vaccine. One of the problems with infection with hepatitis C is that many individuals who are infected with the virus may not show any systemic manifestations of the disease for some time [23]. The same is true for HIV [24].

In most reported cases of transmission of viral hepatitis, the tattooist responsible for the cases used the same needle for several customers sequentially without adequate cross infection control [25]. In fact, the association of hepatitis with tattooing is so well known that recently tattooed (and body pierced) persons are not classed as suitable candidates for blood donations without an adequate ‘quarantine period’ [26,27]. In the United Kingdom and United States of America, this is currently one year from receipt of the last tattoo (or body piercing). In addition, the United Network for Organ Sharing has revised their regulations with regard to patient suitability for liver transplantation. They now give highest priority to the sickest patients with the greatest chance of survival. This means that patients with chronic hepatitis B and C can no longer count on liver transplantation as an option to treat the long-term effects of the disease [28,29].

Most regulated and professional tattooists today take precautions to avoid passing viral hepatitis from one customer to another via dirty needles, ink-wells, or the tattooists hands or cloth. However such cross infection precautions are in striking contrast to those tattoos obtained from friends, unregulated establishments, on the streets, in jails, and in ritual ceremonies in other cultures [30]. Therefore, viral hepatitis infection continues to be a risk of tattooing [21,25,31]. However in a recent study into the link between tattooing and viral hepatitis has concluded that tattoo application is not associated with an increased risk for chronic viral hepatitis. Their data suggests that tattoos may serve as a marker for other high-risk activities that may be responsible for the contraction of hepatitis infections [32]. These high-risk activities include intravenous drug misuse, multiple sexual partners, and homosexuality. Clearly, more research is required into this area.

Both the United Kingdom Department of Health (Public Health Laboratory Service) and the United States Public Health Service (Centre for Disease Control) recommend Hepatitis B vaccinations to all health care workers and “others who may be exposed through their work” (including tattooists and body piercers), in an attempt to reduce the risks of cross infection [22,33]. There is currently no vaccination available for hepatitis C.
Human immunodeficiency virus (HIV)
The only reported cases of possible HIV infection from tattoos were of two men who received tattoos in prison [34]. Both men denied homosexual activity, intravenous drug abuse, and blood transfusions. Each man had extensive bodily tattoos performed with unsterile needles which had also been used to tattoo other inmates.

It is a well-documented medical fact that viral hepatitis B is more highly transmissible than HIV. A single needlestick injury from an infected host carries with it a 5–30% risk of transmission of hepatitis B, a 3–7% risk of transmission of hepatitis C, and a 0.2–0.4% transmission of HIV [35,36]. It is therefore no surprise that with the rapidly repetitive process of tattooing, transmission of sufficient blood for HIV is more likely to occur. In addition to the tattooing needles themselves, HIV has been shown to remain infective in aqueous solutions at room temperature for up to fifteen days [37]. Pigmented solutions, because they are relatively inert, may support the virus as well as these aqueous solutions.

Infectious complications of skin piercing

An infective organism may be introduced into the piercing site in two main ways. Firstly, when the piercing is carried out with poor technique and unsterile instruments; and secondly, during the aftercare of the piercing site when the wound is not kept clean or is handled by the client [16,31].

Inflammation at the piercing site may be so severe it may actually envelop the piercing itself. Keloid, pseudolymphoma, lymphadenopathy, and sarcoidal tissue reactions have also been reported around the piercing point [5,16,38].

Bacterial infections

Staphylococcus aureus
S. aureus is the organism most often reported with regard to infected piercings. It has been linked to several post-piercing complications such as ear abscess, haematogenous osteomyelitis, diarrhoea, chronic neutropenia, and toxic shock syndrome [16,38–42].

Pseudomonas aerogenosa
Infections caused by this type of bacterium occur mainly when piercing of the auricular cartilage has been carried out [16,42]. In several cases, the infection has become so severe that empirical medical measures failed to control the spread of infection. Surgical resection of the necrotic tissue (in addition to parenteral antibiotics) was necessary to control the infection. This left some patients with a surgical reconstructive challenge [43].

Streptococcal species
Life threatening complications have been associated with Lancefield Group A B-haemolytic streptococci. These have included severe erysipelas, septic arthritis, acute glomerulonephritis, toxic shock, and endocarditis [16,44]. Antibiotic prophylaxis is now considered necessary (prior to body piercing procedures) for all those individuals who are deemed ‘at risk of infection’ [45–47]. Not all piercers and customers may be aware of these potential risks.

Escherichia coli
Genital piercing is more likely to be infected with bacteria from the periurethral microflora. E. coli is the commonest bacterium to cause urinary tract infections [48], but it cannot be assumed to remain the infecting pathogen in the presence of a foreign body.

Other bacteria
M. tuberculosis and Clostridium tetani have also caused serious complications and even death following piercing [7,16,38]. These thankfully occur with relative infrequency.

Viral infections

Herpes and pox viral infections
There have been no firm reported incidences to date to indicate transmission of these viruses during the skin piercing process.

Viral hepatitis
Like tattooing, hepatitis B and C viruses are of particular importance here and are among the growing alphabet of hepatitis viruses that are being discovered. Hepatitis D is a defective virus only capable of infecting people who are infected with hepatitis B. Like hepatitis B and C, hepatitis D is spread parentally.

Reported routes for transmission of viral hepatitis include skin piercings and tattooing [16,21,23]. Although the primary risk factor for contraction of viral hepatitis is intravenous drug abuse, the contribution of skin piercing (and tattooing) in the general community is likely to be low [25]. This does not mean that they do not pose a significant individual risk if proper infection control is not in place. In addition, both skin piercing and tattooing are common among intravenous drug abusers [25].
Prions

The word prion is short for proteinaceous infectious particles [49]. The medical community first officially recognized them in 1982 as the vector responsible for the transmission of the human spongiform encephalopathy ‘Creutzfeldt-Jakob disease (CJD)’, from cattle infected with bovine spongiform encephalitis (BSE) [50]. Prions have been shown to be incredibly resistant to standard sterilizing methods, and the fear is that one could spread CJD between persons receiving body piercings even when strict cross infection procedures are apparently in place. Prions have now been added to the list of well-known infectious agents that includes bacteria, viruses, fungi, and parasites [50]. The prions resistance to sterilization has lead several hospitals and primary care centers to implement the practice of ‘single use instruments’ wherever possible especially if the patient is suspected of carrying or suffering from CJD. Thankfully there have been no reports as yet of transmission of CJD or its variants to a person as a result of a skin piercing or tattooing procedure.

Other complications

Although body piercing itself is an ancient practice, oro-facial piercings appear to be a more recent practice in Western society [43]. The first report of a potentially life threatening complication involved a spreading infection from a tongue piercing which resulted in Ludwig's angina and airway compromise [51]. Tongue piercing can also cause severe haemorrhage if not carried out correctly [52]. A recent case demonstrated this when a patient collapsed in hypotensive shock secondary to tongue piercing. She required prompt resuscitation to replace the amount of blood lost [53]. Most professional medical and dental bodies are strongly against tongue piercing.

In another reported case a patient undergoing a routine surgical procedure under general anaesthetic had to be resuscitated as a result of heavy blood stained secretions in the oro-pharynx [54]. Apparently the patient neglected to remove a tongue piercing which had become traumatized during the intubation and bled significantly occluding her airway. This and other cases reported in the medical literature has lead many hospital departments to request removal of body piercings on elective admission of patients [54–57]. Those patients who are admitted via the emergency department pose an even greater problem to removal of body piercings especially if they are unconscious. Removing jewelry is even more difficult if there is infection and swelling in the tissues surrounding it. Jewelry must be removed from an unconscious patient before an X-ray or computer aided scans can take place since the metal can scatter the X-rays rendering the pictures of poor diagnostic yield or useless [58]. Most medical doctors do not know how to remove some common body piercing jewelry. Only 6 of 28 emergency room doctors interviewed were aware of how to safely remove such piercings [59].

Piercings that are within the ‘danger triangle of the face’ carry with them a potential risk of serious infections [60]. This is a roughly triangular area of the face extending from the supra-orbital areas down to the upper lip area. It includes the eyebrows, eyes, nose, and upper lip. This is the territory drained by the facial veins. In addition to this, the supra-trochlear and supra-orbital veins drain the orbit and surrounding adjacent areas. All these veins have direct communication with the cavernous sinus and infections starting in a superficial part of the skin within the triangle could spread to the deep veins of the head causing cavernous vein thrombosis and even meningitis. The risk of these infectious complications arising is small but should be considered significant. As yet, there has not been a reported case of cavernous sinus thrombosis secondary to an oro-facial piercing.

Other reported complications include; disease transmission, aspiration, prolonged bleeding, local infection, chipped or fractured teeth leading to dental infections, mucosal or gingival trauma leading to soft tissue infections [52,61,62].

Discussion

The practice of body piercing and tattooing appears to be increasing in popularity. Although few cases of infective complications have been reported in the medical literature, it is reasonable to assume that health care providers will be called on to treat complications resulting from these practices. Many individuals performing tattooing are relatively uninformed about proper techniques necessary for avoiding infectious complications. Tattooing is common in groups of individuals among whom HIV, hepatitis, syphilis, and tuberculosis are prevalent. Thirty percent of prisoners in Norway, 34% of male prisoners with hepatitis B in Italy, and 47% of male prisoners/53% of female prisoners in Canada were found to be tattooed [16]. In 1992, a randomly sampled survey of 450 British soldiers found that 44% had been tattooed [16]. Thus the practice of tattooing could transmit organisms to others.
Body piercing will continue, so prevention of infection must be of concern. Many bacterial infections have been shown to occur following piercings, and the risks of contracting hepatitis B or C are very real. Although no cases as yet have been reported in the medical press, it is probable that HIV may also be transmitted through unsterile shared piercing tools. Transmission of HIV has been shown to occur with acupuncture treatments and therefore comparable to body piercing and tattooing [16].

Of great concern is the lack of regulation of those who perform tattoos and body piercings and the facilities they may use. Some states within America have implemented strict licensing and sterilization policies with specific regard to body piercings [63]. It is a federal offence not to adhere to these regulations. No clear data on frequency of body piercing within a population exists, but it is estimated that between 73 and 83% of women in the United States of America have had their ears pierced; between 34 and 52% of these women have had complications of some sort respectively [16].

Education through public health measures, should promote the prevention of infectious disease transmission. Particular populations who could benefit from education include prisoners, those in correctional institutions, youths, military personnel, and health care providers who come into contact with populations at risk form the infective complications of tattooing and skin piercing.

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References

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