



Under the skin

LEDER

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An important part of our defence against infection is preventing infectious agents from getting under our skin.

A couple of square metres of skin is all that stands between us and a world of infectious and toxic agents. The skin is our first line of defence against infection. This defence has several parts (1–3). The first physical barrier to foreign microbes is the stratum corneum. Its acidic environment with few trace metals makes life challenging for intruding microbes. In addition, commensal microbes – the normal flora – secrete antimicrobial peptides that drive away foreign intruders (4). If infectious agents pass through the stratum corneum into the epidermis itself, the skin cells promptly detect them and initiate an immune response through the secretion of antimicrobial peptides, cytokines and chemokines. The skin is usually able to distinguish between harmless normal flora and pathogenic microbes.

Only when the skin barrier is breached do we realise its importance. A compromised barrier, as with burns, pressure ulcers, diabetic ulcers and some skin diseases, significantly increases the risk of local skin infections. Artificial holes in the barrier can provide a direct route into the body for infectious agents, such as when non-sterile injections and tattoos introduce dangerous blood-borne viruses such as HIV, hepatitis B and hepatitis C into the body. Intravascular catheters and surgical procedures create openings for infectious agents, while sharp force injuries and bites from snakes and mammals, including humans, can bring infectious agents and spores into the body. Through their stings and bites, insects and other small creatures can introduce the infectious agents that give rise to malaria, yellow fever, dengue fever, Zika, borreliosis and a host of other infectious diseases.

Only when the skin barrier is breached do we realise its importance

A breach of the skin barrier is thus one of the main contributing factors to infectious disease. In this issue of the *Journal of the Norwegian Medical Association*, Olsen *et al.* present the case of a middle-aged woman with an unusual clinical picture (5). The woman had been bitten on the hand by a cat a few weeks previously, and it was this important piece of information that led doctors to the correct, and rare, diagnosis.

The case serves as a reminder that animal bites must be taken seriously (6). The skin barrier has been breached, and microbes and spores from the animal's oral cavity and intestines may have passed through the skin. Each millilitre of saliva can contain billions of microbes.

Cat bites are particularly serious as a cat's small, pointed teeth can penetrate deep into tissue and deposit infectious agents in tendons, bones and joints. Dogs and cats were responsible for almost all animal bites treated at the Oslo Accident and Emergency department over a two-year period (7).

The risk of infection after an animal bite is considerable (8–9). Prevention starts with thorough cleansing of the wound with soap and water. Any dead tissue should be removed. Large wounds should be assessed by a surgeon, preferably a plastic surgeon. Only minor wounds that are recent (less than 8–12 hours old) and on areas other than the hands and feet can be stitched up. Phenoxyethylpenicillin prophylaxis should be given for four days. If the patient has previously received primary vaccination against tetanus, but more than five years have elapsed since the last dose, a single dose of tetanus vaccine is recommended. If the patient has not received primary vaccination, a more comprehensive regimen is required (5). If the animal bite occurred abroad, the risk of rabies must be evaluated and managed as appropriate. The patient should be followed up frequently to allow any early signs of infection to be detected.

The management of bites from humans is fairly similar. As the human oral microflora is different from that of other animals (8), there is no risk of tetanus or rabies, but broader antibiotic coverage with dicloxacillin for ten days is required in addition to phenoxyethylpenicillin (9).

The risk of infection after an animal bite is considerable

It is essential to treat all wounds to restore the skin barrier. Although injections administered by the healthcare service are safe, non-sterile injections by drug users still cause significant spread of hepatitis C virus in Norway. Good hygiene practices are important during intravascular catheter insertion and surgical procedures. Infections after animal bites can be prevented (8–9). When travelling to warmer climates, it is important to prevent mosquito bites with protective clothing, mosquito nets and insect repellent; malaria prophylaxis is also appropriate for some destinations. Here in Norway, tick bites can easily be prevented when moving through heather, grasses or scrubland: Tuck trousers into socks, stick to the path and use insecticides with diethyltoluamide (DEET) (10).

Since skin damage and puncture wounds in healthy skin are important causes of infection, preserving the skin barrier is an effective defence against infection. It helps us keep microbes on, but not under, our skin.

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