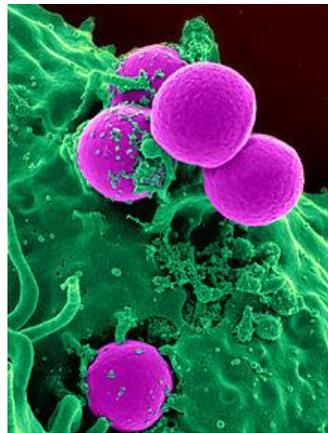


## Methicillin-Resistant Staphylococcus Aureus

Key words: staphylococcus, staphylococcus aureus, staphylococcus epidermidis, MRSA, methicillin resistant staphylococcus aureus, antibiotics, infection, prosthetic infection, infected joint replacement, superbug

### MRSA or the “Superbug”

Staphylococcus is a strain of common bacteria which is found in many situations in daily living and the environment. It is a common organism that can be found on the skin and orifices of in normal healthy people. There are various strains of the staphylococcus. The epidermidis is commonly found on normal skin. The aureus variety less commonly so. The aureus variety is commonly associated with hair follicles skin abscesses and infected wounds. The staphylococcus can be troublesome in post surgical wound infections. It can prove difficult to eradicate if the wound is contaminated with dirt, earth, clothing, a foreign body or even after prosthetic implantations. Long term antibiotic use in situations where due to contamination the infection is difficult to eradicate may allow the staphylococcus bacteria to genetically mutate and form resistance to the antibiotic. This promotes the development of resistant strains. Methacilin is one of the antibiotics reserved for serious and threatening infections. Over the last 30 years a strain of methacillin resistant staphylococcus aureus has developed around the world: MRSA.



Scanning electron micrograph of a human neutrophil ingesting MRSA

### Staphylococcus aureus

*Staphylococcus aureus* is a bacterium, bug or germ which is very similar to many other bacteria. The bug commonly causes boils, abscesses or general infections of skin. It is commonly found on healthy skin or in the nose as a normal commensal organism of the skin. It is often just called Staph. Aureus or *S.aureus* as an abbreviation'. In fact, as many as 3 in 10 people have *S. aureus* bacteria normally living on their skin. These people are called *S. aureus* 'carriers'.

In healthy people who are carriers, the *S. aureus* on their skin or in their nose is usually harmless to them as the carrier in this situation. If however the skin is damaged, the patient is in poor health or hygiene, if the immune system is suppressed or damaged, or a significant injury occurs, then the organism may become more active and virulent. In these situations the bacterium multiplies and grows causing a clinical problem and infection then results.

If there is a cut or graze to the skin the skin *S. aureus* bacteria can cause infection. In more severe infections *S. aureus* can get into the bloodstream and travel to internal parts of the body. For example, blood poisoning; septicaemia, pneumonia, bone infection or osteomyelitis, heart valve infection and endocarditis all result from *S.aureus* blood borne infection. These infections need to be treated with antibiotics.

### MRSA (Methacillin resistant staphylococcus aureus)

The Methicillin-resistant Staphylococcus aureus (MRSA) is a bacteria responsible for several difficult-to-treat infections. It is also called oxacillin-resistant Staphylococcus aureus (ORSA). MRSA is any strain of Staphylococcus aureus that has developed, through the process of natural selection and genetic mutation resistance to beta-lactam antibiotics, which include the penicillins (methicillin, dicloxacillin, nafcillin, oxacillin, etc.) and the cephalosporins. Strains unable to resist these antibiotics are classified as methicillin-sensitive Staphylococcus aureus, or MSSA. The evolution of such resistance does not cause the organism to be

more intrinsically virulent than strains of *S. aureus* that have no antibiotic resistance, but resistance does make MRSA infection more difficult to treat with standard types of antibiotics and thus more dangerous. MRSA is especially troublesome in hospitals, prisons, and nursing homes, where patients with open wounds, invasive devices, and weakened immune systems are at greater risk of infection than the general public. MRSA began as a hospital-acquired infection, but has developed limited endemic status and is now sometimes community-acquired and livestock-acquired. The terms HA-MRSA (healthcare-associated MRSA), CA-MRSA (community-associated MRSA) and LA-MRSA (livestock-associated) reflect this distinction.

There are various sub-types (strains) of *S. aureus* and some strains are classed as MRSA. MRSA strains are very similar to any other strain of *S. aureus*. However the genetic make up of the bacteria has evolved such that the bacterium is resistant to many antibiotics. The drug which was previously used to treat severe staphylococcus infections was methicillin. Unfortunately many years ago various strains of *S. aureus* become resistant to methicillin. These strains then became more difficult to treat and were named methicillin resistant staphylococcus aureus or MRSA strains. These strains were previously universally sensitive to Vancomycin which was the antibiotic reserved for use in MRSA cases. However further mutations of the MRSA *S. aureus* has resulted in some “superbug” strains which are now resistant to Vancomycin and another important antibiotic Ticoplanin. Infection with these “superbug” MRSA multi-resistant strains can prove very difficult indeed to treat.

These MRSA bugs are usually found more commonly where concentrations of infections occur in hospitals. This is understandable, predictable and has always been the case. However two recent factors have occurred. Some of these MRSA organisms are being found in community acquired infections outside of hospitals. Some people have become carriers of the MRSA strain of *S. aureus*. It has also been suggested that poor cleanliness in hospitals has exacerbated the problem. As a result it is unfortunately now not uncommon for an MRSA infection to be acquired whilst in hospital. Many hospitals screen patients for such infections before high risk treatments such as cardiac surgery or joint replacement. This has also led some patients being advised to leave hospital as soon as they are able and remove themselves from the hospital and going home where the environment is such that there is a lower risk of acquiring an MRSA infection whilst convalescing. Methicillin Resistant Staphylococcus aureus or MRSA is a strain of *S. aureus* which has mutated and become resistant to the more commonly used antibiotics including methicillin. In recent years some strains of *S. aureus* have become resistant to some antibiotics and become MRSA strains. The difference is that, most *S. aureus* infections can be treated with commonly used antibiotics whilst MRSA cannot. More recently multiresistant MRSA has been detected. In these MRSA strains the bacteria have also become resistant to the antibiotic Vancomycin; the antibiotic usually reserved for MRSA treatment.

MRSA strains of bacteria are no more aggressive or infectious than other strains of *S. aureus*. However, infections are much more difficult to treat and bring under control because many antibiotics do not work. Therefore, infections tend to become more severe than they may otherwise have been if the cause of the infection is not diagnosed early, and appropriate antibiotics are given and the organism does not develop multi-resistance.

MRSA occurs most commonly in people who are already in hospital, debilitated, malnourished or who have compromised immune systems. Commonly people also have chronic wounds or open sores such as bed-sores or burns. The wounds or sores may become infected with MRSA and the infection is then difficult to treat. Infections which start in the skin may spread to cause more serious infections. Also, urinary catheters and tubes going into veins or parts of the body are sometimes contaminated by MRSA and can lead to urine or blood infection.

MRSA can also cause infections in people outside hospital, but much less commonly than in hospitalized people.

*S. aureus* bacteria (including MRSA strains) spread from person to person usually by direct skin-to-skin contact. Spread may also occur by touching sheets, towels, clothes, dressings, etc, which have been used by someone who has MRSA.

However, as mentioned, *S. aureus* including MRSA strains will not normally cause infection if you are well. The bacteria may get onto your skin, but do no harm. So, for example, people who visit patients with MRSA, or doctors and nurses who treat people with MRSA, are not likely to develop an MRSA infection. But, they may become 'contaminated' with the bacteria and may pass it on to someone who is ill, or who has a wound, who then may develop infection.

### Diagnosis

If an infection with *S. aureus* or MRSA is suspected then, depending on the type of infection, a swab or tissue sample is sent to the laboratory for bacterial analysis. This sample may be a sample of blood, urine, body fluid, or a swab of a wound. If *S.aureus* is detected, further tests are done to see which antibiotics will kill the bacteria. MRSA strains can be identified by multiple antibiotic resistance on testing. Healthy people suspected of being carriers of MRSA can have a swab or the nose or skin taken and tested.

### What is the treatment of MRSA infections?

MRSA infections are usually treated with antibiotics as are other staphylococcal infections with antibiotics. However early and careful testing is necessary in order to identify which antibiotics are effective against the specific strain of MRSA. Many MRSA infections can only be treated with antibiotics that need to be given in hospital directly into a vein. The course of treatment is often for several weeks. Also, the risk of side-effects with the limited choice of antibiotics is higher than the more usual antibiotics which are used to treat non-MRSA infections.

People who are carriers of MRSA but who are healthy do not need any treatment. However, in some cases it may be advised to try and clear the bacteria from the skin by washing with antiseptic lotions, and using antiseptic shampoos, and using an antibiotic cream to place in the nose. These measures may reduce the risk of spreading the bacterium to others particularly within a hospital setting.

### Prevention

The number of MRSA infections in hospital can be reduced if all hospital staff adhere to good hygiene measures. The most important of these is to wash hands before and after contact with each and every patient, and before undertaking any invasive procedure. This simple measure reduces the chance of passing on bacteria from patient to patient.

Other measures are used in hospitals to reduce the spread of infection. For example, cleaning of bedding, regular cleaning and sterilisation of wards, etc. Patients with an MRSA infection may be kept isolated away from other patients, perhaps in a single bed room or in an isolation unit until the infection has cleared. Staff should wear isolation gowns when treating such patients which are changed on leaving the room. Staff may be routinely screened and tested to see if they have themselves become carriers of MRSA, or tested when there is a local outbreak of infections. If staffs have become carriers then the contamination can be eradicated by antiseptic washing and using a nasal antibiotic cream for a few days until clear of MRSA *S.aureus*.

Further patient information:

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