Microbe of the month

Breaking The Chain of Infection

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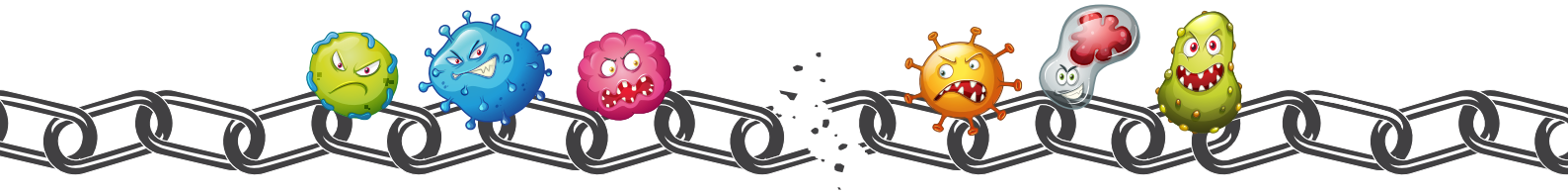
January 2019
Newsletter
Compiled by Helen Loudon, Independent IPC Practitioner



Featured in this issue:

Methicillin resistant Staphylococcus aureus

MRSA

Applied Microbiology

Staphylococcus aureus (pronounced '*staf-ill-oh-KOK-us AW-ree-us*') is a common, Gram-positive, potentially pathogenic commensal bacterium found in warm, moist areas of the body, particularly the nose, axilla and perineum.
Approximately 30% of the human population are ***colonised*** with the bacterium – that is, they carry Staphylococcus aureus but it does not cause them harm and they do not require treatment.

However, within the healthcare environment this means that potentially both patients and staff can act as a ***reservoir*** and ***source*** for the spread of Staphylococcal infection to susceptible individuals.

Staphylococcus aureus (S. aureus) is responsible for a large spectrum of infections from superficial abscesses, boils and wound infections to the more serious infections of osteomyelitis, septicaemia and pneumonia.

Methicillin-resistant Staphylococcus aureus (MRSA) refers to a group of Staphylococcal bacteria that are genetically distinct from other strains of Staphylococcus aureus. Therefore, MRSA is any strain of Staphylococcus aureus that has developed - through horizontal gene transfer and natural selection - multiple drug resistance to beta-lactam antibiotics.
(β-lactam antibiotics are a broad-spectrum group of penicillin derivatives such as Ampicillin, Amoxycillin, Augmentin, as well as the cephalosporins.) Historically, certain strains of S. aureus became resistant to penicillin and an alternative antibiotic – methicillin - was introduced in 1960. However, it wasn't long before resistant strains were reported in 1962 with many serious hospital outbreaks. Methicillin (or cloxacillin) is now used as a screening process in the laboratory for sensitivity testing - hence the title MRSA. Strains of S. aureus which are normally killed by these antibiotics are classified as methicillin-susceptible S. aureus, or 'MSSA'.

It is also important to recognise that multiple strains of MRSA exist, and that MRSA colonisation and infection can be acquired from healthcare facilities (Ie., 'hospital acquired MRSA referred to as HA-MRSA') as well as ***from the community*** (Ie., 'community acquired MRSA' referred to as 'CA-MRSA').
In 1972, MRSA was found in milk from Belgian cows with mastitis, and MRSA infection is now reported in many diverse animal species. Of concern are 'companion animals' such as dogs, cats, sheep, chickens, rabbits, horses, parrots/parakeets and even guinea pigs.
In 2003, a pig-farming associated strain of MRSA (ST398) was first identified in the Netherlands and is now a ***global pandemic*** due to exportation, abattoirs and pig to human transmission.

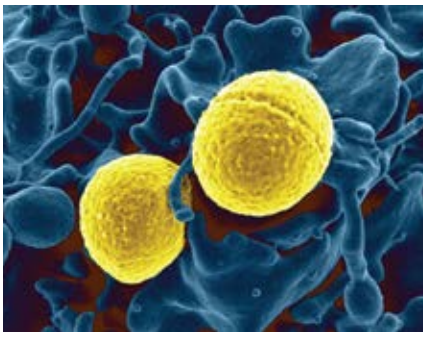
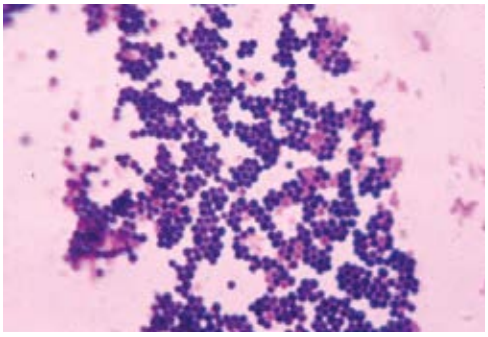
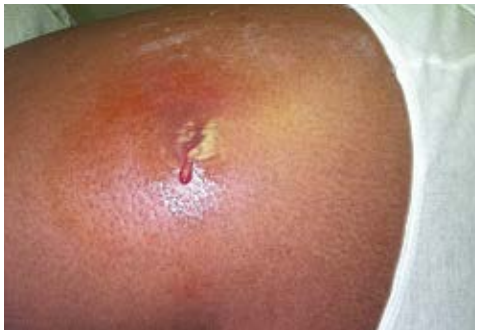


Image clearly depicting the thick defensive cell capsule of S. aureus



Microscopy Gram stain depicting navy blue clusters of S. aureus



Community acquired MRSA skin infection (abscess)

Why does antibiotic resistance matter?

Resistant bacteria tend to occur when antibiotics are overused or abused (Ie., when not needed, or used inappropriately - the wrong antibiotic, wrong dose, frequency etc). Antibiotic pressure 'selects' for these organisms, so it is clear that adherence to ***antibiotic stewardship*** in not only healthcare, but also veterinary and livestock farming applications is fundamental in the management of this problem.

The life-threatening infections caused are difficult to manage due to limited treatment options. Replacement treatments are generally more toxic and expensive and may need a longer duration of treatment to work effectively, which exponentially increases the risk of further complications.

BE ANTIBIOTICS AWARE
SMART USE, BEST CARE

The implications for a patient who contracts MRSA in hospital include extended length of stay, loss of income, pain, scarring, anxiety and depression. For the hospital staff, the effects include increased workload, disruption to ward routine and may even result in temporary ward closures.The financial cost to both the patient and organisation is immeasurable.

The wide spectrum of infections caused by Staphylococcus aureus and MRSA

Exotoxin related	Gastroenteritis, 'toxic shock' and 'scalded skin' syndrome.
Skin and soft tissue	Boils, impetigo, mastitis, wound (leg and pressure ulcers), **surgical site (SSI)** and burn infections.
Musculoskeletal	Septic arthritis, osteomyelitis, joint abscesses.
Respiratory	Pneumonia – hospital or community acquired.
Medical device related	Phlebitis and central line associated blood stream infection **(CLA-BSI)**; post orthopaedic, vascular and prosthetic implants, ventilator associated pneumonia (VAP), urinary infection post catheterization or urological instrumentation.
1° and 2° bacteraemia related infections	Septic shock, 2° metastatic septic foci (kidney, joints, lung), bacterial endocarditis.

How is MRSA spread?

The primary mode of transmission of MRSA is by ***direct contact***, usually via a person's hands, although cross infection via environmental and equipment contamination also plays a role (referred to as 'indirect contact' transmission.)

MRSA may also be released into the atmosphere on the millions of skin squames shed daily, as well as fibres from clothing and carried as dust particles. Therefore, scrupulous attention to hand hygiene is essential, patient care equipment reprocessed according to accepted standards and environmental surfaces kept visually clean and free from dust.

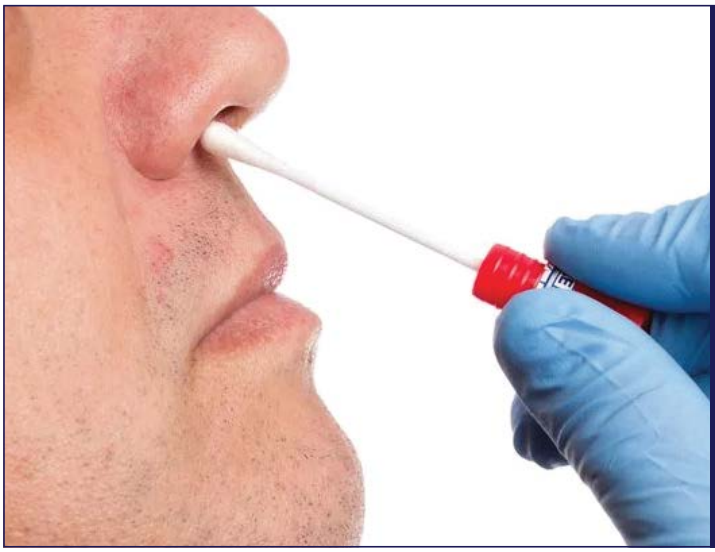
How is MRSA diagnosed?

It is estimated that between 70% and 90% of hospitalized patients colonised with MRSA are never identified as such by routine culture of specimens. MRSA 'carriage' (Ie. colonisation with MRSA where the individual has no symptoms) is usually identified accidentally, when unrelated diagnostic laboratory cultures are undertaken – for example, urine, sputum and wound specimens.

Examples where targeting screening may be helpful is pre-operatively (vascular, orthopaedic or neurosurgical cases in particular), upon transfer from another facility (including Frail and Long-Term Care) or upon admission to ICU. Patients receiving multiple courses of antibiotics, those with non-healing surgical wounds, oncology, renal failure or HIV +ve patients - especially those with long term venous access catheters – are at risk of MRSA carriage.

Swabs should be taken from at least 2 sites - high nasal (both nostrils) and from the groin or perineum. The instruction to the laboratory is 'MRSA culture'.

Note: Rapid molecular tests are now available (PCR) – and although more costly, can detect both methicillin and mupirocin resistance in under 24 hours



Should healthcare workers be routinely screened for MRSA carriage?

The short answer is **NO**. In the event of an outbreak situation or "clusters" of MRSA infection in a unit, targeting screening measures should be undertaken with advice from a medical microbiologist. *Swabbing of environmental surfaces is also of limited value and is not recommended.*

Risk factors for healthcare (hospital) associated strains of MRSA	Risk factors for acquiring community associated strains of MRSA
Intensive care, transplant units, orthopaedic and trauma wards, burns units and neonatal units	Homeless people
Hospital stay >7 days	Military personnel living in barracks, prison inmates, students in dormitories, Day Care centres
Invasive catheters, devices and drains	Intravenous drug users
Transfer from another healthcare facility	Competitive athletes, especially contact sports
History of admission to a healthcare facility within the past 12 months	Diabetes mellitus, HIV +ve and immuno-compromised individuals
Broad spectrum antibiotic therapy	Veterinarians, livestock handlers, and pet owners

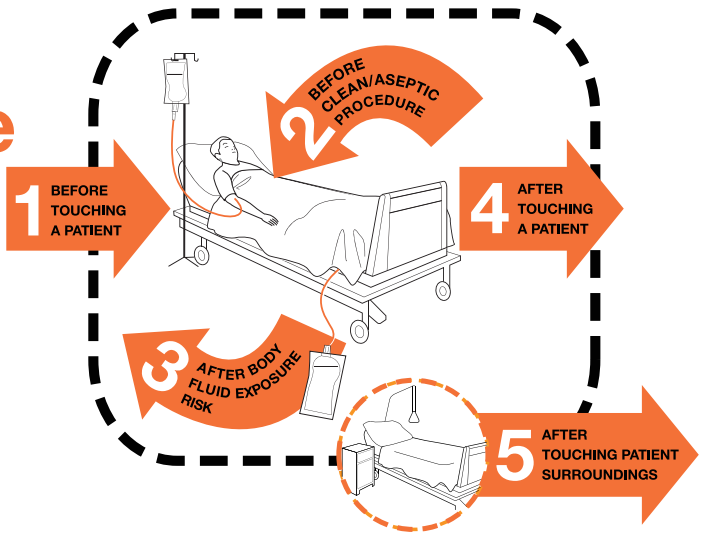
INFECTION CONTROL: the management of patients with confirmed or suspected MRSA carriage and infection

- Isolate the patient and implement contact and respiratory precautions (Ie., ready access to hand basins and 70% alcohol-based hand rub, disposable gloves, aprons and surgical facemasks).
- Cohort multiple cases (combined isolation) with other MRSA patients (provided they have no other infection).
- Careful handling and disposal of used linen (use yellow plastic bags, which should be collected directly from the room) and healthcare risk waste (Eg., dressings).
- Bathe the patient with 4% chlorhexidine gluconate antiseptic liquid soap (Eg.,Bioscrub®).
- Routine bathing of ICU and long-term patients with 4% chlorhexidine gluconate antiseptic liquid soap is also recommended to control the density of skin flora.
- Focus cleaning efforts on high-touch surfaces (Ie., surfaces which come into frequent contact with hands or the patient's skin - door handles, light switches, monitors, cot sides, lockers, overbed tables, bath tubs, and toilet seats).
- Use sodium hypochlorite-based detergent disinfectants for environmental damp dusting (Eg., Biocide-D® 3 gram sachet 4.5 litres of tepid water).
- Clean isolation and ablution facilities last, using designated and colour coded (yellow) cloths, buckets and mops.
- Limit visitors and discourage close physical contact. Stress the importance of hand hygiene before entering the isolation room and upon exit.
- Avoid the sharing of patient equipment and keep only essential equipment and furniture in the room – avoid clutter!
- Avoid inter-hospital transfer of patients where possible (unless they have been screened for MRSA beforehand).

- Operating theatre: MRSA positive patients should be operated on at the end of the list.
    - o All non-essential equipment should be removed to prevent contamination for subsequent patients.
    - o Minimal staff should be present in the theatre to prevent cross-contamination between staff and patients.
    - o Patients ideally should be recovered within the Operating Theatre.
- Discharge MRSA-colonized patients as early as possible.
- 'Tag' patient records electronically to alert hospital personnel if/when that patient is re-admitted. ("Once MRSA, always MRSA" - implement contact and isolation precautions until the screening result is known.)
- Monitor and control the inappropriate use of antimicrobial agents!

Your 5 Moments for Hand Hygiene

1. BEFORE TOUCHING A PATIENT
2. BEFORE CLEAN / ASEPTIC PROCEDURE
3. AFTER BODY FLUID EXPOSURE RISK
4. AFTER TOUCHING A PATIENT
5. AFTER TOUCHING PATIENT SURROUNDINGS



Hand hygiene before and after every episode of patient contact is the single most important procedure to prevent the transmission of pathogens and infection!

The role of MRSA decolonization

Regimens intended to eliminate MRSA colonization should not be used in patients with active infections.
After treating active infections and reinforcing hygiene and appropriate wound care, consider consultation with an infectious disease specialist regarding use of decolonization when there are recurrent infections in an individual patient or members of a household.

MRSA decolonisation (treatment) regimen

25% of patients will become recolonized with MRSA – *therefore, it is prudent to manage patients as if they still have MRSA.*

- **Mupirocin (Eg. Bactroban®) nasal ointment BD to anterior nares for 5-10 days**
- **Shower with chlorhexidine gluconate 4% liquid soap BD (including hair) for 5-14 days**
- **In the community setting - treat household contacts too!**
- **Re-swab the patient's nose and groin not less than 30 days after completion of the decolonization regimen**
- **3 negative cultures are required to confirm clearance**
- **Refer the patient to a Dermatologist if they have a concomitant skin condition (eczema, psoriasis)**

References

1. American Veterinary Medical Foundation (2009) Methicillin resistant Staphylococcus aureus. Available from https://www.avma.org/KB/Resources/Reference/Pages/Methicillin-resistant-Staphylococcus-aureus.aspx **2.** Centers for Disease Control and Prevention (2016). Methicillin-resistant Staphylococcus aureus. Available from https://www.cdc.gov/mrsa/community/ **3.** Centers for Disease Control (CDC) Healthcare Infection Control and Prevention Advisory Committee (2006). Management of Drug Resistant Organisms in Healthcare Settings. **4.** Liu,C., Bayer, A., Cosgrove, S.E. et al. (2011). Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant Staphylococcus aureus Infections in Adults and Children. **5.** World Health Organisation (WHO) 2009 Guidelines for Hand Hygiene in Healthcare **6.** Yong, E., (2009). MRSA in pigs and pig farmers. National Geographic January 23, 2009. https://www.nationalgeographic.com/science/phenomena/2009/01/23/mrsa-in-pigs-and-pig-farmers/

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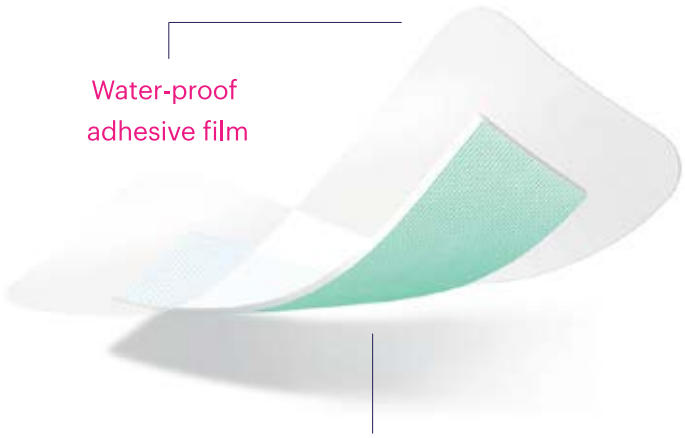

For use on:

- IV sites
- Surgical incisions
- Post-op dehisced wounds
- Lacerations, cuts and abrasions
- Minor burns

* P. J. Stanirowski, et al. Dialkylcarbamoyl chloride-impregnated dressing for the prevention of surgical site infection in women undergoing cesarean section: a pilot study. Arch Med Sci 2016; 12, 2

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