MRSA: Methicillin Resistant *Staphylococcus aureus*

Epidemiology

-Community: 2% colonized
-HCP : 5%
-HCF patients/resident: 8-10%

Transmission
++ Direct contact: hands
+Indirect Contact: less common: Fomites, Environmental surfaces
±Droplets from Colonized with URTI, low role

•MRSA susceptible to low-level /intermediate-level disinfectants, quaternary ammonium compounds, phenolics, and iodophors (with proper dilutions); 70% isopropyl alcohol for portable equipment (stethoscope…)
•General routine cleaning & disinfection of housekeeping surfaces and patient-care surfaces adequate for inactivation of MRSA
•Traditional disinfection
–w phenolic disinfectant (spray, immediately wipe dry) only 85% effective
–not as good as "active damp scrubbing" with the same phenolic disinfectant

Source:
++Human carriers,
-Pet animals
-Fomites, environment

Colonization:
-Nasal passage common,
-Axillae, groin, moist skin
-Rectum
-Sputum, trach site in intubated
-May last for months or yrs

Incubation 2d
Difficult to determine because of carriers

Infection:
-Suppurative wound in skin /soft tissue
-Bacteremia / Septicemia
-Focal internal abscess
-Pneumonia, meningitis,

Communicability: Colonized /infected throughout carriage or infection

Risk factors for colonization:
• Severity of illness
• Previous expo to antimicrobial
• Underlying disease conditions,:
º Chronic renal disease
º Insulin-dependent diabetes
º Peripheral vascular disease
º Dermatitis or skin lesions
• Invasive procedures:
º Dialysis
º Invasive devices
º Urinary catheterization
º Ventilators
º Repeated contact with the healthcare system
º Previous colonization by an MDRO
º Advanced age
Colonized person at higher risk of infection

Judicious use of antibiotics has very little effect on MRSA epidemiology since most cases are the result of transmission of existing resistant bacteria and NOT de novo development of resistance

Diagnosis

Basic bacteriology
-Penicillin resistance: In1940s *Staphylococcus aureus* rapidly produced a β-lactamase able to inactivate the penicillin ring. Gene mecA responsible for β-lactam resistance
-**Methicillin /oxacillin** =penicillin derivatives with radicals shielding the penicillin ring
-**Methicillin resistance:** In 1960s, *S.aureus* modified its penicillin binding site → MRSA
-Resistance results from 4 mec genes: I to IV chromosomal elements encoding penicillin-binding proteins . Genes in staphylococcal cassette chromosome (SCC)

-HA-MRSA: First appeared in the 1960s and progressed as a hospital strain
-Types I , II and III
-Many strains cause sporadic in-patient cases, few strains (EMRSA) cause epidemics
-Most are simple colonizers; NOT more virulent than other SA; NO difference in animal lethality, in production of enzymes, in production of toxins associated with invasiveness
-Multi-resistant: Penicillins and derivatives, macrolides, cipro and other fluoroquinolones, cyclines, trimethoprim-sulfa. Sensitive to vancomycin, linezolid
-CA-MRSA: Appeared in the 1990s as community-associated then proliferate to become the most frequent strain (in HCF and community)
-Type IV smaller cassette replicating faster than other types. Predominant clone in the U.S. is strain US300
-More virulent, severe pneumonia, higher lung bacterial density, greater expression of regulatory genes associated with virulence factors (PVL leukocidin and α hemolysin)
-Link to Arginine Catabolic Mobile Element (ACME) promoting pathogenicity
-Other pathogenicity "islands": TSS, exotoxin, enterotoxin islands
-Fewer antibiotic resistance genes
-Doubling time shorter than HA-MRSA

1-Culture of *S.aureus* and confirmation of MRSA with antibiogram
-Differentiate between colonization from real infection; important in case of pressure ulcer.
-Generally less costly, common practice most labs are used to
-May take 72 hours to identify MRSA colonized patients. If pre-emptive isolation not employed, may allow for transmission prior to recognizing patient as positive
2-Polymerase chain reaction
-Rapid results
-Expensive , technically more challenging

Treatment

-Localized mild to moderate skin and soft tissue infection (SSTI): Incision and drainage
-Patient with severe /extensive disease or rapidly progressing systemic symptoms and risk factors for severity, **assume MRSA** (Predictive value for MRSA rather than MSSA is very poor.

Oral antibiotics
-Trimethoprim/Sulfamethoxazole
-Doxycycline or Minocycline
-Clindamycine
-Linezolid

Parenteral antibiotics
-Vancomycin
-Ceftaroline
-Linezolid
-Quinupristin/Dalfopristin
-Televancin –
-Daptomycin
-Tigecycline

Control

1-Surveillance

- **Only invasive cases are reportable:** Positive culture from blood, CSF, other internal fluid, organ infection. Do not report skin and soft tissue infections (SSTI)
- **Tag the medical records of MRSA** colonized or infected patients. Upon readmission use contact precautions and repeat cultures
- Warn receiving HCF when a patient is transferred
- **Active surveillance:** screening to detect colonization even if no evidence of infection Widely used and even recommended as a core prevention strategy by some, but precise role remains controversial. At admission /discharge
- **NO routine active case finding in LTCF.**

LTCF may NOT arbitrarily refuse to accept a resident with MRSA colonization or infection if the facility can address satisfactorily the medical needs of the patient

Discontinuation of contact precautions after 2 negative cultures of colonized or infected site.
-First 72 hrs after antibiotic Rx
-Second 1 week after

2-Interrupt transmission from person to person: Standard and Contact Precautions in hospitals (h) or Modified Contact Precautions in LTCF (m):

- **Hand-washing** or **alcohol-based hand sanitizers (hm)**
- **Contact precautions** including

Gloving whenever touching:
- patient
-surfaces contaminated including areas in contact with the patient
-high touch surfaces as bedrails, light switches, faucets
-uncontrolled secretions, pressure ulcers, draining wounds, stool incontinence, ostomy bags

Gowning whenever getting in the room (h) or only when close contact with secretions & excretions, damaged skin (m).

Masks if close to patient with URTI, suctioning respiratory secretions , irrigation of large wounds

- Patient placement:

-Private room with a bathroom solely used by the patient
-If private room not available, cohorting with another MRSA.
-If sharing room at least a 3 foot separation between beds to avoid inadvertent sharing of items between patients.
-Avoid sharing room with patient with feeding tube, IV line, tracheostomy tube, urinary catheter (any device entering orifice or breaching skin)
-Curtain or a red tape on the floor identifying areas of restricted access (h)

- Equipment: Dedicated to patient (h) or properly disinfected (m)
- Proper handling of contaminated waste and fomites
- Patient transport: Transportation or movement outside the room should be limited in hospital. In LTCF allow movement but educate patient about proper hand hygiene.

-Contact precautions status need to be communicated to all HCP susceptible to come in contact with the patient.

- Linen handled as other linen: collected, bagged at bedside and sent to laundry
- Cleaning: Focus on frequently touched areas: bedrails, bedside commodes, bathroom and fixtures, doorknobs, light switches, remote controls, monitor cables, call buttons
- Ambulatory patient (m): may attend activities

-if nares or sputum colonized (no need to wear mask if able to cover cough or sneeze) and other colonized sites are covered.
-good hygiene and hand washing

3-Preventing infection in colonized individuals:

3a-Not MRSA-specific: Strategies aimed at preventing device and procedure-associated infections (e.g., ventilator associated pneumonias, central line associated bloodstream infections, etc), not necessarily

3b-MRSA Specific = Decolonization:

-In theory decolonization would reduce the load of MRSA BUT it requires use of local and systemic antibiotics and that leads to widespread resistance
-Use decolonization sparingly
-Use in case of outbreak or special circumstances in consultation with an Infectious Disease Specialist
-Monitor by culture the sensitivity of the strains to detect any shift towards resistance
-Strong indication for surgery

Nose: mupirocin (Bactroban Nasal) into anterior nose
If mupirocin-resistant, use 1% chlorhexidine and Naseptin Cream

Other Sites:

- Antiseptic detergent (chlorhexidine, povidone-iodine, Triclosan) for skin and hair
- Mupirocin (Bactroban) to treat lesions (eczema, pressure sores)
- Hexachlorophene powder (0.33% Sterzac powder) on axillae and groins if colonized. Do not use on broken areas of skin. Use cautiously in infants.
- In cases of throat or sputum colonization, topical nasal applications ineffective.
- Urine: remove the catheter, if possible. If not, change half way through Rx.

3-Employee Health

-Employee hand carriage is usually transient
-Surveillance cultures of HCP for MRSA not recommended unless in outbreak situation
if employees epidemiologically implicated as source –-HCP infected should be treated with antibiotics. –
-HCP with skin lesions or dermatitis to be removed from direct care until healing of lesions
-HCP with respiratory infections /cough not to be assigned to direct care.

3-Education of healthcare providers, patient and visitors

HCP need to understand the difference between infection and colonization

Cleaning ENV PERSIST

Thorough cleaning is necessary to maximize the disinfectant action of the germicide.
Use a commercially available solution which contains a detergent or use a detergent for thorough cleaning before applying the bleach solution. Contact time of 1 minute should be sufficient. Wetting the surface with the bleach solution and allowing it to dry should provide sufficient contact time.