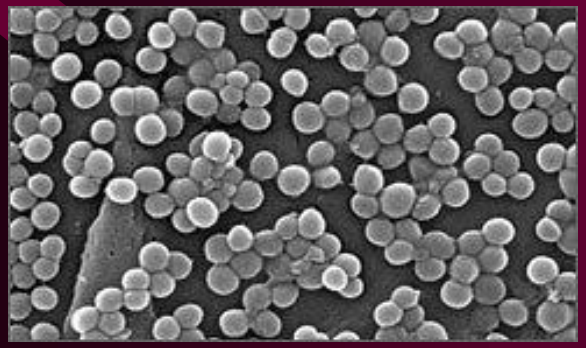
Ca-MRSA Update- Hand Infections

Washington Hand Society

September 19, 2007



Resistant Staph. Aureus

- Late 1940's -50% S.Aureus resistant to PCN
- 1957- 80/81 strain- of S.A. highly virulent and easily transmissible strain spreads world-wide
- 80/81 carried nasally, caused septicemia in 30% of all carriers, responsible for all epidemic outbreaks in US maternity wards and 50% of all hospital based outbreaks in the UK
- 1961-incidence died down- advent of methicillin

Methicillin Resistance

- 1960-three resistant isolates discovered, 6 months after Meth. was introduced.
- 1967- resistant strains found all over Europe and India
- 1981- First Gentamycin resistant SA in US and Europe
- By 1990- sixteen strains of MRSA identified

Ca- MRSA

- 1993- Western Australia among Aborigines not exposed to health care system.
- Entirely different class of SA from hospital acquired

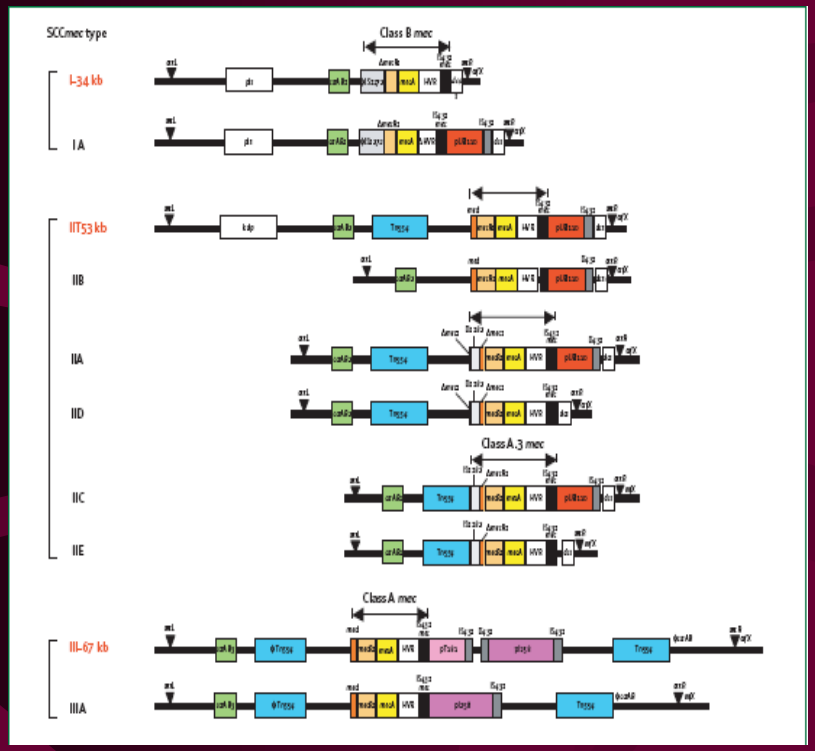
Staph Aureus resistance timeline

1941 – Introduction of penicillin into treatment of infectious disease
1944 – *S. aureus* penicillin resistant
1960 – New penicillinase-resistant drugs are used to fight staph infections (i.e. methicillin)
1975 – Methicillin-resistant strains of *S. aureus* emerge
1988 – 2.4% *S. aureus* are methicillin-resistant
1989 - .3% enterococci vancomycin-resistant
1991 – 29% *S. aureus* methicillin-resistant
1993 – 7.9% enterococci vancomycin-resistant
1996 – *S. aureus* strain with intermediate vancomycin resistance reported in Japan
1998 – Man in New York dies from a staph infection

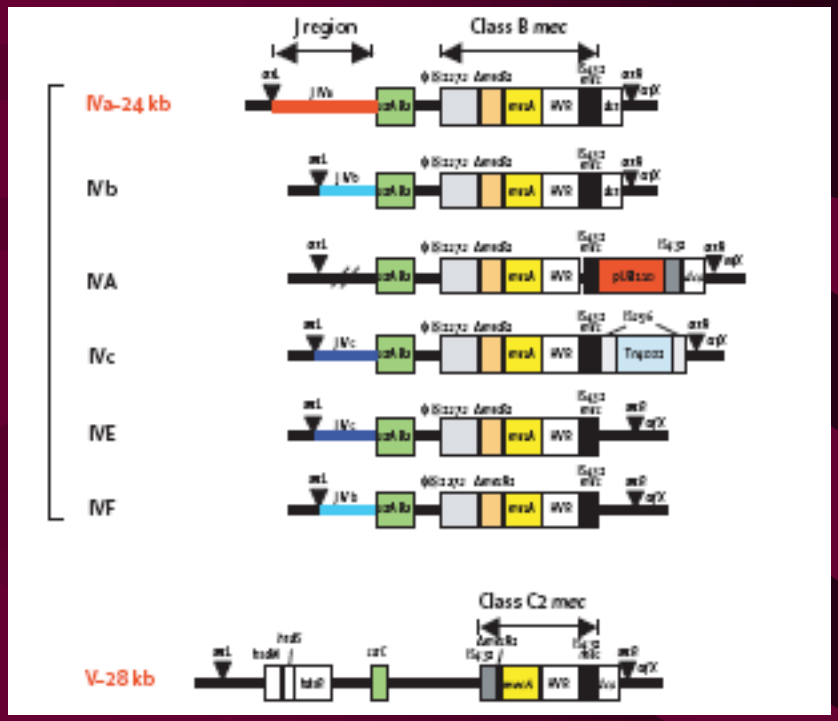
Ca MRSA vs. HaMRSA

- Ca-more susceptible to non B -lactam antibiotics
- Differ in genotype sequences USA-300/100
- Differing Meth. resistant “cassettes” (plasmids): SCCmec type IV
- Panton-Valentine virulence factor

Ha-MRSA long sequences



Ca-MRSA short sequences



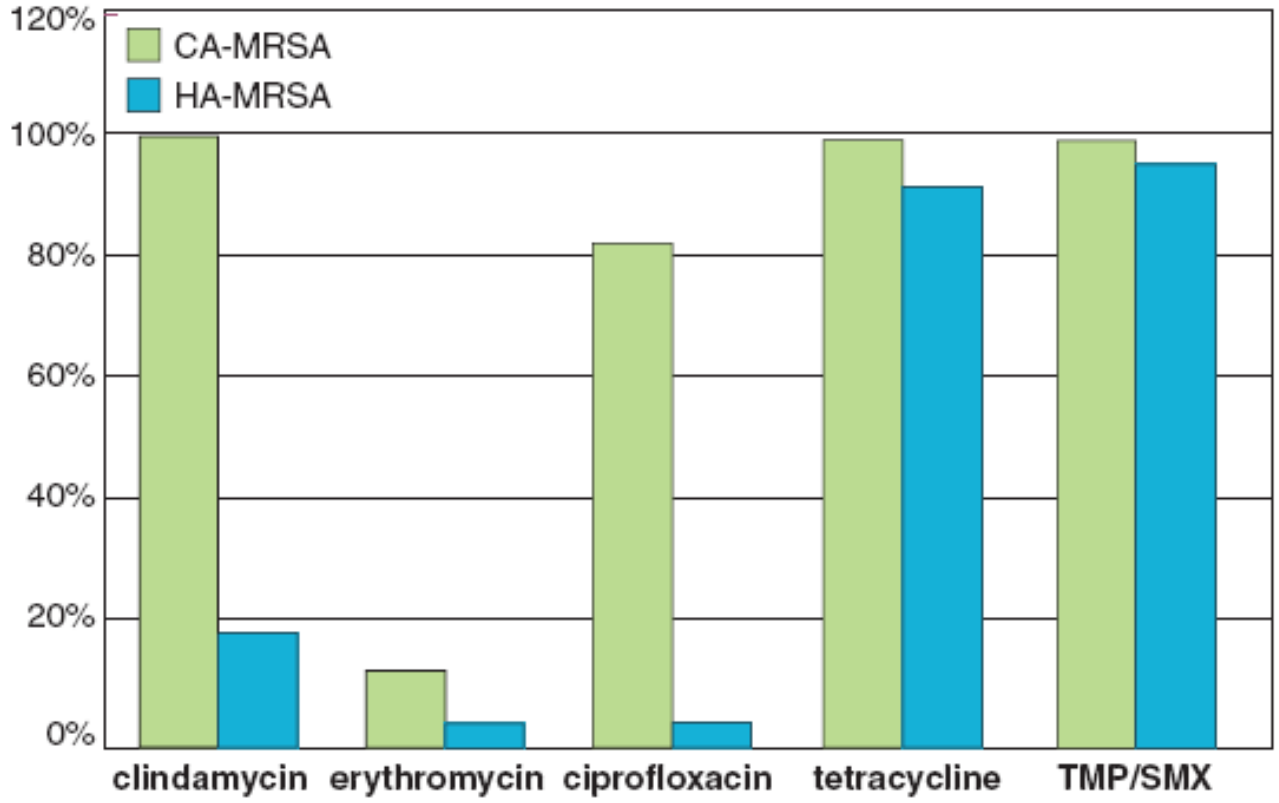


Figure 3. Comparison of antibiotic susceptibilities between CA and HA MRSA isolates.

Populations Reported: high intensity physical contact

- IV Drug users
- Homeless
- Gay Men
- Prison inmates
- Military recruits
- Children in Day Care
- “Contact” Sports Teams

Characteristic	CA MRSA n = 26 (%)	HA MRSA n = 25 (%)
Age, years *		
Mean (range)	38.7 (4-82)	59.7 (20-84)
Sex		
Male	17 (65)	9 (36)
Female	9 (35)	16 (64)
Race		
Caucasian	11 (42)	16 (64)
African-American	13 (50)	9 (36)
Hispanic	2 (8)	0
Comorbidities		
CAD[1],*	2 (7.5)	13 (52)
DM[2],*	0	11 (44)
ESRD/HD[3],*	0	5 (20)
Malignancy*	1 (3.8)	6 (24)
IVDA[4]	3 (11.5)	2 (8)
HIV[5]	2 (7.5)	0
Various	3 (11.5)	4 (16)
None known*	16 (61.5)	0
Site of infection		
Scalp/face	3 (11.5)	4 (16)
Upper extremities	3 (11.5)	2 (8)
Lower extremities*	10 (38.5)	3 (12)
Abdomen/Chest	0	3 (12)
Spine*	1 (4)	8 (32)
Various	0	1 (4)
Unknown	9 (34.5)	4 (16)

[1] Coronary artery disease, [2] Diabetes mellitus, [3] End-stage renal disease / Hemodialysis, [4] Intravenous drug abuse, [5] Human immunodeficiency virus;
* P-value<0.05 (statistical comparison was performed by chi square analysis)

Table 1. Patient Characteristics

St Louis Rams

Kazakova NEJM 2005 single clone MRSA

- 2003 season 5/58 players on the Rams got MRSA skin and soft tissue infections
- All abscesses occurred at the site of previous injury i.e. turf burns and lacerations uncovered areas
- Transmitted by close personal contact from infected lesion or secretions-lineman, linebackers
- Use of showers, whirlpools, and shared towels and clothing, and weight room surfaces not shown to transmit.
- Teams playing the Rams got sporadic cases

Nasal Carriers?

- From 2000-2005 numerous sports teams from High School to the pro's
- Wrestling, soccer, football, rugby, basketball
- Originally thought to be carried nasally
- Mupirocin ointment given nasally ineffective in stemming outbreaks
- Role unclear

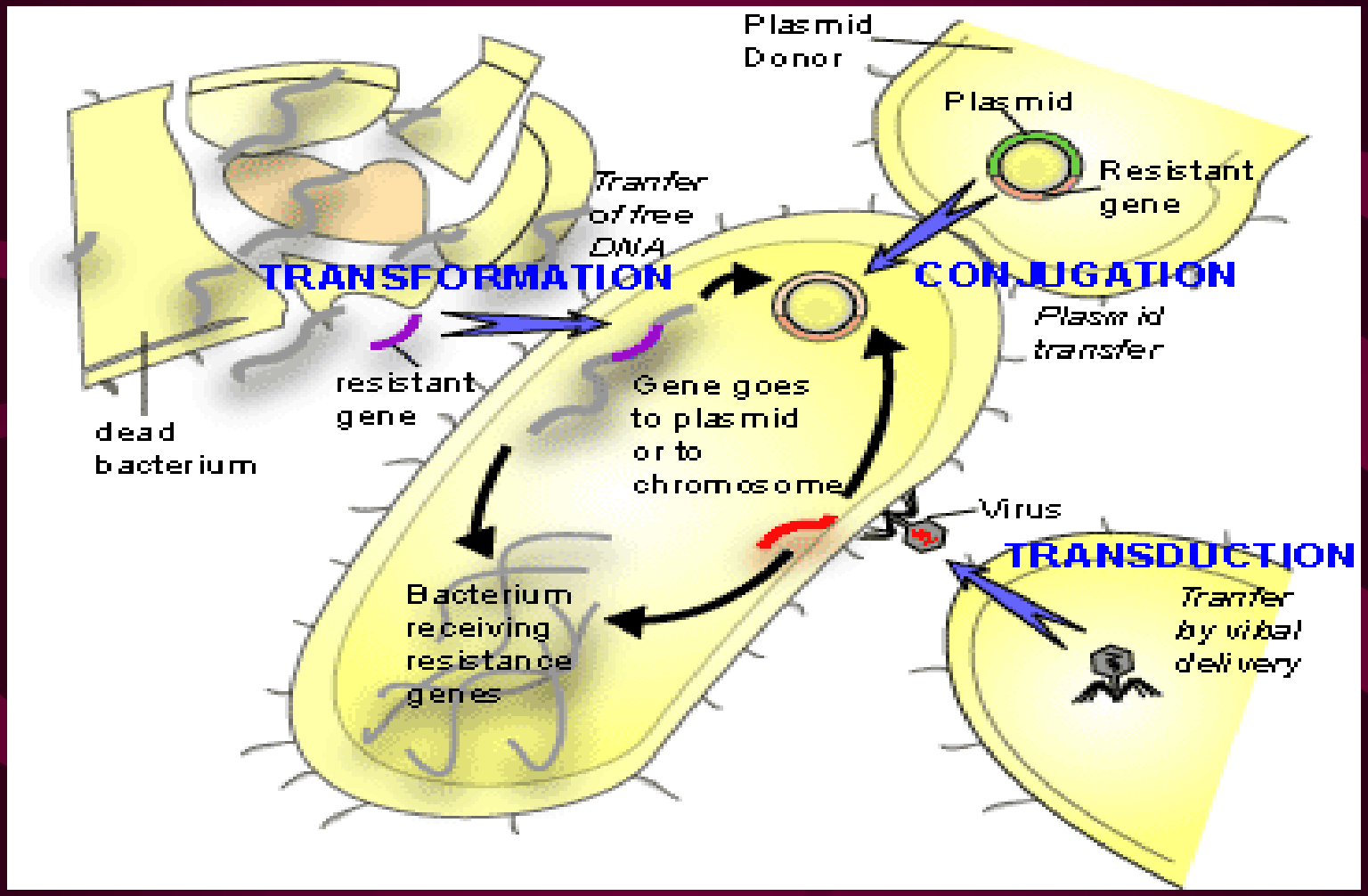
Vancomycin Resistance

- 1997- first HaVRSA reported
- 2002-first CaVRSA –Detroit drug user
- Conjugative transposition from co-infected patient with VRE. New York City
- van-A gene transfer from enterococcus
- VISA (intermediate sensitivities MIC>4mg/L) not clinically responsive
- Now multiple strains of VRSA identified

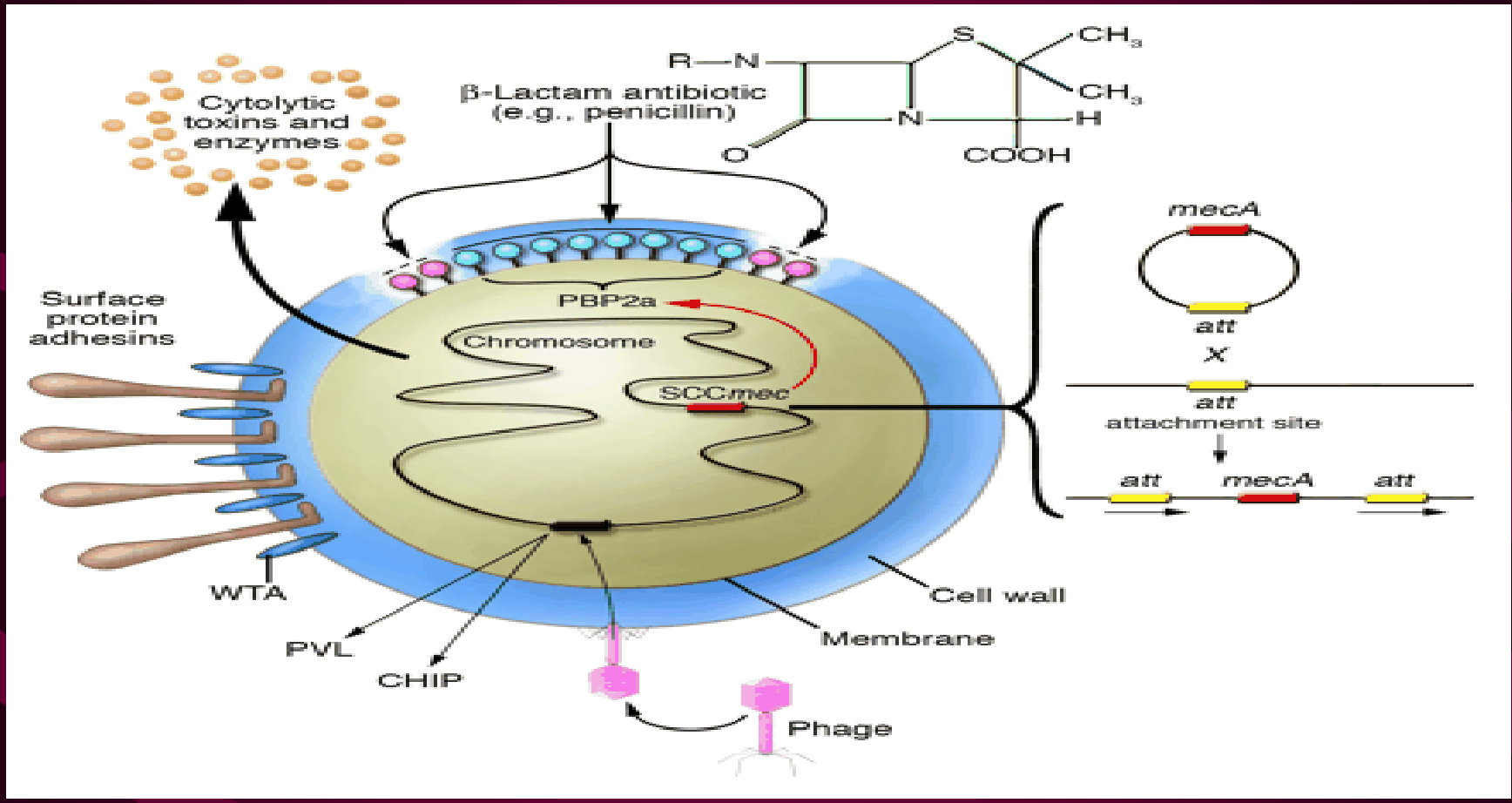
Lysis of cell wall

Figure1. Trans electron micograph of Staphylococcus aureus and antibiotic effect.

Horizontal gene transfer



Mechanism of Resistance

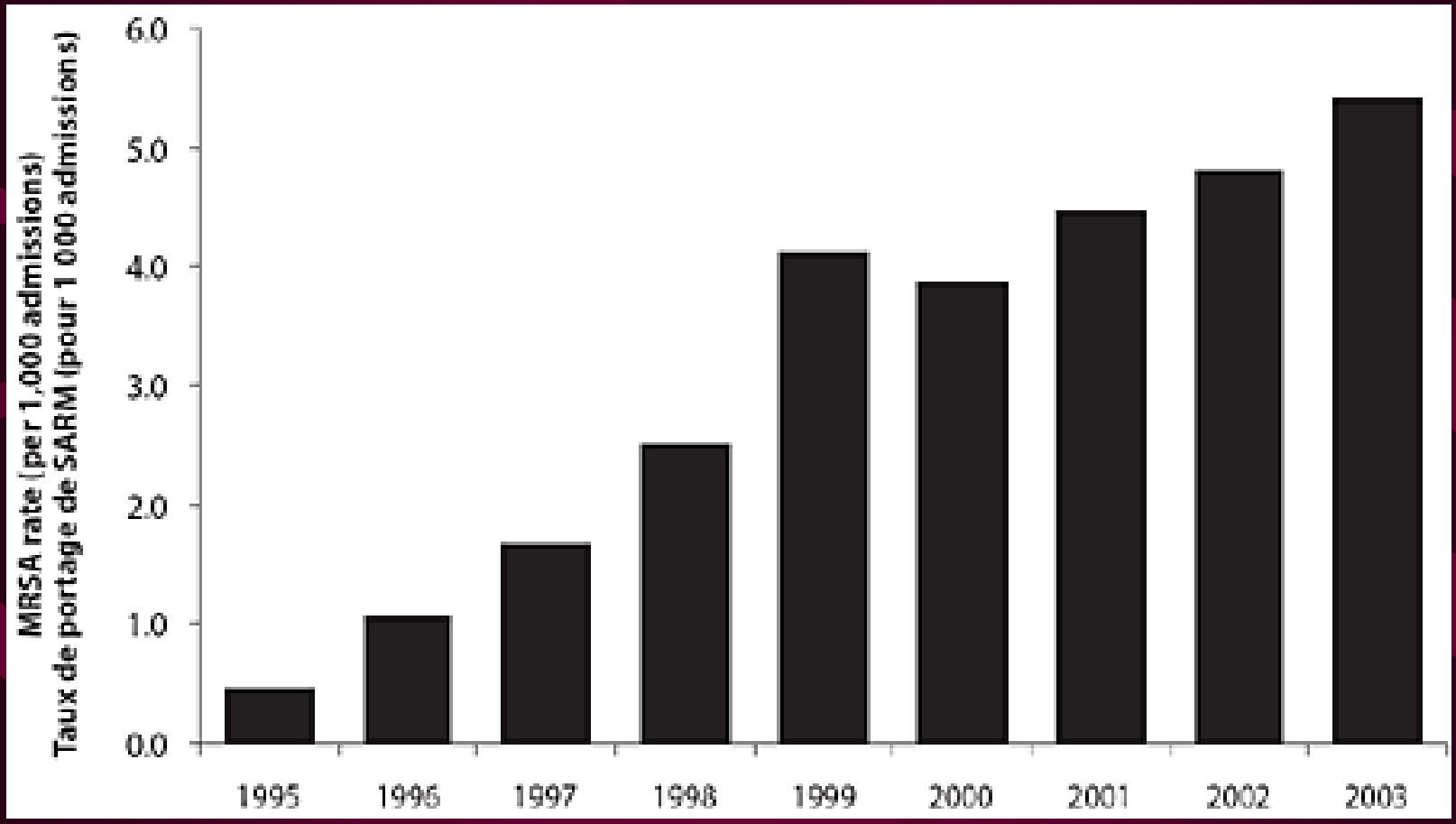


- SCCmec gene produces PBP2a- cell wall B lactam insensitive

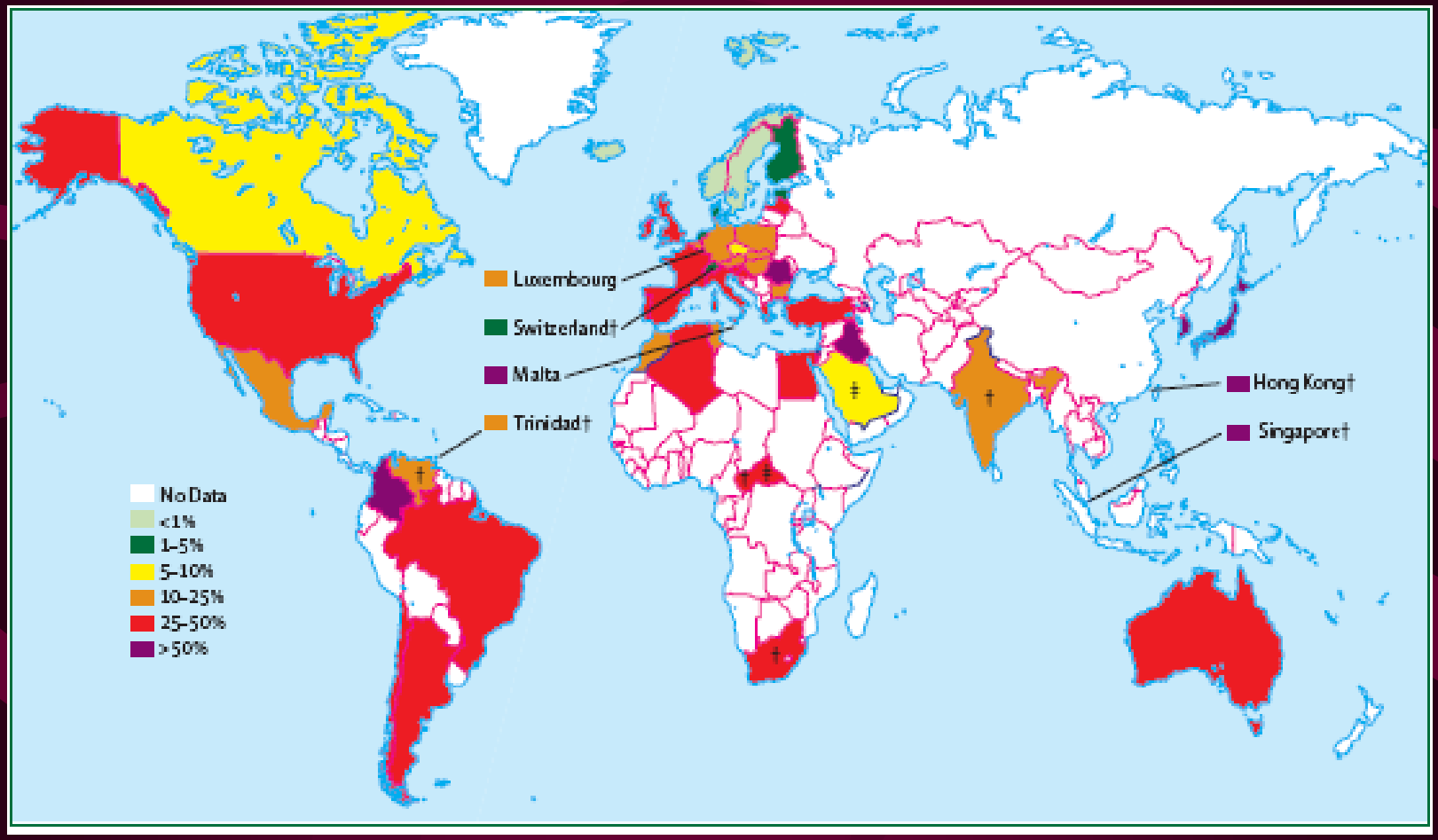
Today

- MRSA is most common antibiotic resistant pathogen in the world
- World wide rates are soaring
- 20% of all MRSA are community acquired

Ca-MRSA rate Canada



World-wide prevalence by country



Moran NEJM 2006

- 11 university affiliated ER's around the US
- 320/422 patients with skin-st infections were S.A. (76%)
- MRSA were 59% (15-74%)
- USA-300 -97%
- SCCmec type IV, PV leukocidin toxin 98%

Ca- sensitivities

- Vancomycin ?
- Clindamycin 95%
- TMP-SMX + rifampin 100%
- Tetracyclenes (doxycyclene,minocyclene) 92%
- Flouroquinolones-60%

Clinical Manifestations

- Skin and soft tissue infections
- Septic arthritis
- Bacteremia
- Toxic Shock Syndrome
- Necrotizing fasciitis/cellulitis/pneumonia
- Traumatic wound infections

CDC Criteria

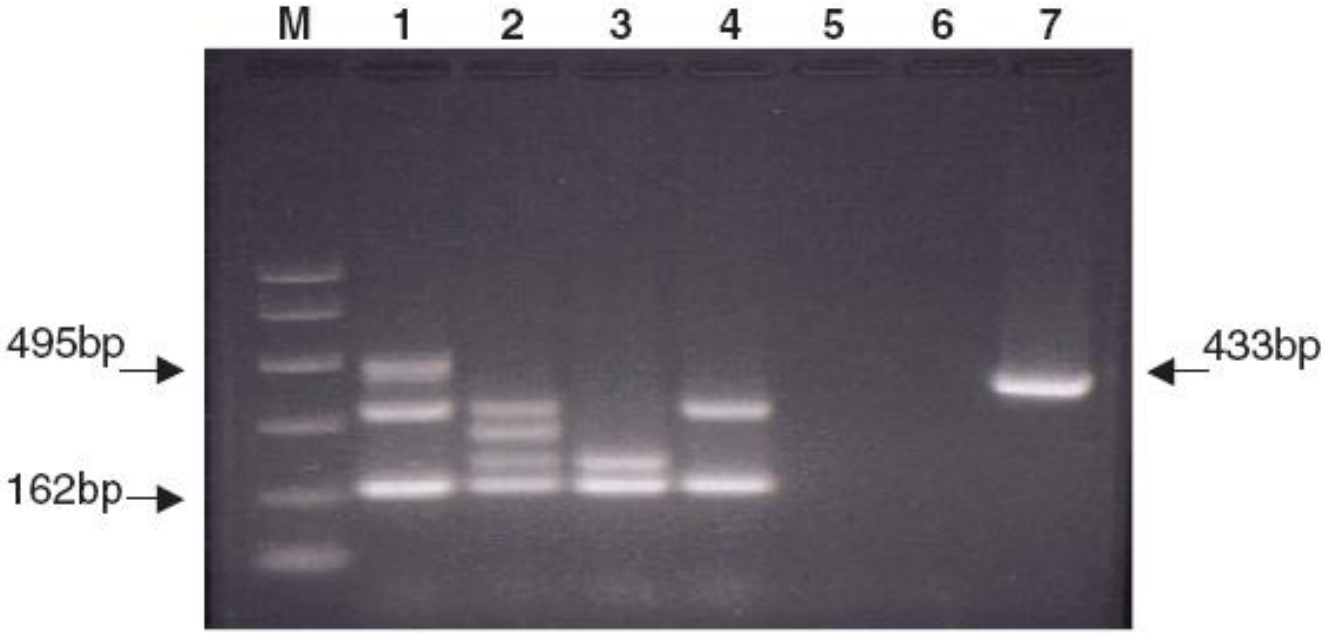
- Dx. made in outpatient setting or + culture with 48 hrs of hospitalization
- No hx of MRSA infection or colonization
- Ho hx. Of admission to health-care facility in past year or dialysis or surgery
- No indwelling catheters or implants

Diagnosis

- Detailed History r/o spider bites
- Local cultures
- Pulsed -field gel electrophoresis
- Recurrent skin infections not responsive to B lactam antibiotics
- “Polymerase chain reaction amplification” to detect virulence factors

Brown Recluse spider bites

Gel electrophoresis



M-marker; 1-*SCC*mec type I; 2-*SCC*mec type II; 3-SCCmec type III;
4-SCCmec type IV; 5-blank; 6-PVL negative; 7-PVL positive;
162bp: *SCC*mec gene internal control; 495bp: *SCC*mec type I top band;
433bp: PVL

Figure 1. Detection of SCCmec types I-IV and PVL by PCR assays in CDC control isolates

.8/2005 13:47 REZAIE,MASSOUD DOB: 11/22/56

M0531800130 DIS-M20860100 Page

Order No: 3 6207 - CULTURE WOUND SUPERFICIAL W/SMEAR

Specimen: No Description Test Status: F Collection Date/Time: 11/14/05 10

Source: FINGR Collected: 11/14/05 10:30
Site: Left Received : 11/14/05 15:30

GRAM STAIN DIRECT FINAL 11/14/05 17:45
11/14/05 Rare WBC's
Many Gram positive cocci in pairs and clusters

CULTURE WOUND SUPERFICIAL W/SMEAR FINAL 11/16/05 13:16
Isolate: Staphylococcus aureus
Many
Methicillin Resistant - precludes the use of all currently available beta lactam antibiotics.
This organism does not demonstrate inducible clindamycin resistance in vitro.

Organism	S.aureu	
Antibiotic	MIC	INT
Clindamycin	<=0.5	S
Erythromycin	>4	R
Linezolid	<=2	S
Oxacillin	>2	R
Synercid (Quinupristin/Da	<=1	S
Trimeth/Sulfa	<=2/38	S
Vancomycin	<=2	S

S=SUSCEPTIBLE I=INTERMEDIATE R=RESISTANT POS=POSI

End of Report!

Treatment-1

- If local area has high incidence of MRSA routine use of B- lactam antibiotics as a first- line drug may not be indicated
- Localized skin infection can be treated with I&D?
- 95% of MRSA sensitivity to TMP-SMZ but double the dose is used, can be used with Rifampin to lower “inducible resistance”

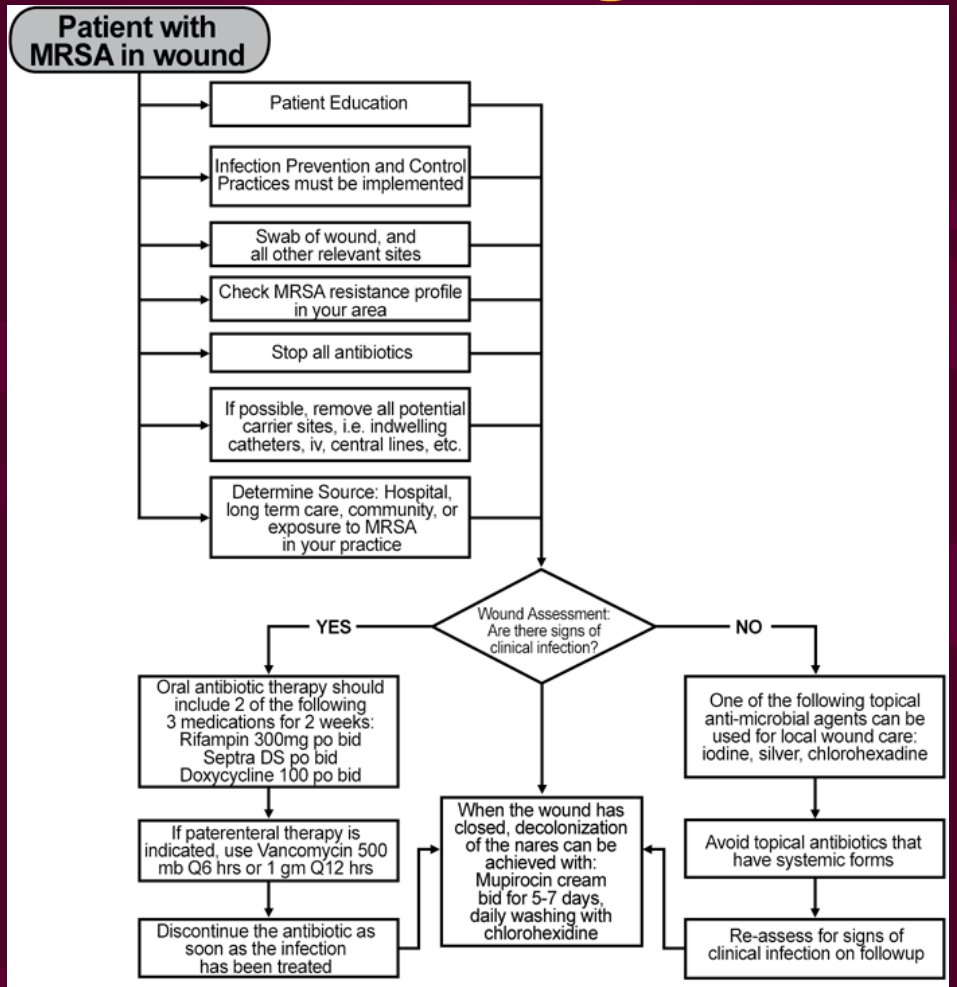
Treatment- 2

- Clindamycin –(children)
- Flouroquinolones- ciprofloxacin, (moxifloxacin, gatifloxacin)--resistance
- Tetracyclenes (minocyclene, doxycyclene)
- Vancomycin –mainstay
- Linezolid best forVRSA
- ?daptomycin,tigecyclene-new

Ceftobiprole

- A new class of cephalosporin binds to pennicillin binding protein PBP2 allowing the B-lactam to break down the cell wall
- Is refractory to development of resistance by Staph……..so far

Treatment algorithm



Necrotizing Cellulitis

Necrotizing Fasciitis

Finger lesion- Patient claimed a spider bite

Wide excision needed, not an”I&D”

Prevention in group settings

- Personal and environmental hygiene
- Rigorous laundry procedures
- All cuts and open wounds need to be covered
- “Nasal” prophylaxis

One article in JHS July 2000

- Karanas and Bogdan
- 4 cases of skin infection by Ca-MRSA treated with I&D and Vancomycin uncomplicated course

My experience

- 7 cases in the past year
- 5 finger lesions, 1 hand, 1 forearm lesion
- 3 treated with IV Vanco as OPD
- 4 with Bactrim po
- All resolved

This is just the tip of the iceberg

- A recent study found that one in five stethoscopes used by clinicians were contaminated with Staph Aureus, including one that harbored MRSA