Universal MRSA Screening
— Does the burden caused to healthcare institutions benefit the patient?

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Epidemiology of MRSA

Compared with MSSA, MRSA infections have increased risk of:

- mortality \((x2)^{(1,2)}\), morbidity \((2,3)\), prolonged hospitalization \((3)\), increased healthcare costs and hospital resource utilization \((2,4)\)

  (Controlled

Epidemiology of MRSA

- Nearly always (in UK) hospital or healthcare associated
- Usually brought into hospital by patient carriers
- Colonisation precedes infection
- Organisms are usually transferred via staff hands

Colonisation may last months/years
Patients re-admitted or transferred to another institution are sources for new cross-colonisation/infection
This 'revolving door' epidemiology has made national and international control difficult
Colonisation

(1) Colonised patients are a source for cross-infection to others
(2) Also at risk of endogenous surgical site infection with MRSA

- Therefore:
  (1) screen patients at or before admission and isolate/decolonise carriers

(2) delay surgery for decolonisation and/or use MRSA surgical prophylaxis
Does isolation, de-colonisation & prophylaxis work?

- There is little evidence that isolation is more effective than ‘barrier nursing’, but it may be
- Decolonisation does not eradicate MRSA but reduces the burden and therefore potentially the risk of transmission and SSI
- There is limited evidence that specific MRSA prophylaxis works, but it is logical by extension from data on other surgical prophylaxis
Screening before elective surgery

- Universal screening
- Targeted screening
  - Target high risk surgery
    - surgery in patients with a high rate of MRSA carriage and/or a high risk of disastrous outcome with MRSA infection
    - Orthopaedics, vascular, cardiac
  - Any prosthesis

- Avoidance of litigation
Screening before elective high risk surgery

- Ideally done in pre-admission clinics up to 18w before surgery
- Therefore can use slow screening methods
- Universal screening, low yield (<1%)
Screening before **emergency high risk surgery**

- Not quick enough unless using PCR
  - Costly, nasal only
- Alternatively, use pre-emptive anti-MRSA prophylaxis
- Make risk benefit analysis locally
All admissions screened by nasal swab using PCR
Carriers treated with mupirocin/chlorhexidine before surgery
11/8980 patients developed MRSA SSI (0.12%)
Of these, 6 (55%) had negative preoperative screens
Of the 5 with positive preoperative screens, only one received treatment to eradicate the carrier state.
‘Conclusion: Failure to treat the carrier state before surgery results in MRSA SSI’.

PS. Low prevalence rate; Cost of screening kits ~ £200,000
FIG. 3. Relationship between MRSA prevalence and assay PPV. The present investigation is indicated with a filled circle, and previous reports with open circles, taking culture confirmation as the basis for both prevalence and PPV calculations. The trend line represents our laboratory’s predicted PPV over a range of prevalences, calculated on the basis of our previous reports of local specificity and sensitivity (20). Incorporated studies reported or gave clearly calculable figures for prevalence and PPV of PCR in relation to culture outcome (4, 6, 7, 10–13, 15–17, 19–23, 28–31, 33–35, 39–41, 43, 44). (For full details of the references cited, see Table S1 in the supplemental material.)
Targeted vs Universal Screening to prevent transmission

- **Targeted: Risk assessment:**
  - Pre-emptive control
  - Known previous +ve, transfer from elderly care home/other hospital
  - Admission to a ward with high risk of serious outcomes (orthopaedics, cardiac, vascular, ITU, SCBU)

- **Universal:**
  - Required by DH (England) since 2009
  - Still use risk assessment for pre-emptive control
GSTT: Overall MRSA colonisation rate = 2.0% of 28,892 admissions

- Range 6.6% critical care to 0.8% ob/gyn & neonatology.
- Most colonising strains were HA–MRSA 15 & 16
- But 18% were heterogeneous CA–MRSA
  - CA–MRSA = 38% of MRSA from A&E, 23% from surgery, 21% from ob/gyn, neonatology).
- Logistic regression showed that screening 30% of admissions based on risk factors would have identified ~70% of HA–MRSA but only 40% of CA–MRSA. Screening 70% of admissions would have identified 90% of carriers.
Numerous governmental agencies have mandated MRSA screening programs, and yet several authorities in infection control have questioned the appropriateness of mandated screening.
Diekama: The effectiveness of “active detection and isolation” (ADI) remains in question

- The effectiveness of ADI has been argued ad nauseam in the infection control literature, so in the interest of conserving space I refer the reader to two recent systematic reviews, to the CDC MDRO guidelines, and to a joint statement issued by the two major U.S. infection prevention professional societies (SHEA & APIC)
These publications summarize the literature and conclude that the existing evidence is not strong enough to support adoption of MRSA ADI as a routine infection prevention measure.

The effectiveness of ADI remains in question

- Why? Because almost all the published studies are of limited quality, in most cases due to an observational, before-and-after study design, the absence of concurrent control groups, and the inclusion of multiple interventions, making it difficult to determine the contribution of ADI to the observed MRSA reductions.
The effectiveness of ADI remains in question

- For example, the most widely cited recent study of universal ADI lacked a control group and included interventions other than ADI (1)
- In contrast, the largest-ever controlled trial of universal ADI demonstrated no difference in MRSA infection rates associated with ADI use (2)

Evidence that MRSA HCAIs rates are declining due to basic hospital IPC practice

- Catheter-associated MRSA BSIs declined by >50% in U.S. ICUs since 2001 without widespread use of ADI
- England reduced MRSA BSIs by 57% 2007–9 without universal ADI (mandatory admission screening was introduced April 2009)
- EARSS now has more countries with decreasing rather than increasing MRSA BSI rates although most do not perform universal MRSA ADI


MRSA Bacteraemia, England 1990-2010
Number of death certificates in England & Wales mentioning MRSA
Office for National Statistics online 2010
Annual number MRSA bacteraemia episodes

2001-2010 Guy’s & St Thomas’ Hospital

MRSA bacteraemias reduced -90.3%, rate -89.2%
Much new data on (cost-) effectiveness of MRSA screening
But conflicting results and numerous questions about appropriate populations for universal vs targeted screening, screening method(s) and intervention(s)
Still lacking robust data on:
  - effect of universal screening on infection and transmission rates
  - cost–effectiveness
In hospitals with an MRSA admission prevalence of <5%, use targeted rather than universal screening, after carefully considering the local MRSA epidemiology, infection control practices and vulnerability of the patient population.

This strategy is likely to be cost effective if linked to prompt institution of control measures.
Fig. 1. Factors to consider and evidence to assess prior to implementing universal meticillin-resistant \textit{Staphylococcus aureus} (MRSA) screening in a specific hospital. HH, hand hygiene.
MRSA infections are costly

- Each patient developing HCAI with MRSA infection has an average excess medical cost of nearly $24,000
- Societal costs of death, amputation etc.
- Any reduction is cost effective???
  [but if a cheaper intervention is just as effective, the more expensive one is not as cost effective]

The most cost-effective interventions are those that prevent transmission and infection

- **Transmission**
  - Hand washing, isolation, decolonisation

- **Infection Prevention**
  - Decolonisation, Anti-MRSA surgical prophylaxis
  - Catheter care
Lee BY et al. Universal MRSA Surveillance for Adults at Hospital Admission: An Economic Model and Analysis. ICHE 2010; 31(6):598–606

- Computer simulation to determine economic impact of universal MRSA admission screening (single nasal culture) at different MRSA prevalences and reproductive rates
- Carriers isolated; non–isolated carriers could transmit MRSA to other patients
- Universal screening was cost–effective (defined as an incremental cost–effectiveness ratio of <$50,000 per quality–adjusted life–year) when the reproductive rate was ≥0.25 and the prevalence was ≥1% greater.
Prospective case–control design and cost–benefit analyses in two community hospitals in Wisconsin. 15,049 adult admissions from April 2009 to July 2010

MRSA PCR screening within 30 days before or on admission

Targeted screening for 9m; universal screening at one hospital during 5m intervention. IPC measures consistent at both hospitals
**Results.** Universal screening was associated with 44% increase in admission screening ($P > .01$), an increase in MRSA detection of 3% ($P > .01$), and a nonsignificant decline in hospital–acquired MRSA infections of 0.12% ($P = .34$).

The benefit–to–cost ratio was 0.50, indicating that for every dollar spent on universal versus targeted screening, only $0.50 is recovered in avoided costs of hospital–acquired MRSA infection.

**Conclusion.** Universal screening was associated with higher costs and was not cost beneficial.
Conclusions

- There is substantial evidence that good, general IPC practice reduces MRSA infection rates.
- There is limited/conflicting/unreliable evidence that universal admission screening has any cost-benefit compared with targeted screening.
- Although there is only limited supporting evidence, it is reasonable to screen high risk elective surgical patients and delay surgery, decolonise and use anti-MRSA prophylaxis.
Conclusions

(1) Review prevalence of HA–MRSA & CA–MRSA in different patient groups

(2) Consider performing targeted screening on admission and act on the results
BUT...beware CA–MRSA

(2) Consider screening high risk elective surgery in pre–admission clinics and act on the results

(3) Critically review mandatory MRSA admission screening