BIOQUELL
Bio-decontamination solutions

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Micro News

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1. Environmental reservoirs of MRSA and VRE: seawater, sludge and swines!

Several recent studies have examined reservoirs of MRSA and VRE outside of hospitals. A Californian study identified MRSA in 7% of 149 seawater samples and 7% of 155 sand samples (Goodwin and Pobuda 2009); a Swedish study identified VRE in 79% of 77 sludge samples on a farm, although the molecular types were different from common human hospital isolates (Sahlstrom et al. 2009); and an extensive Greek environmental study identified VRE in 67% of 30 raw urban wastewater samples, 17% of 12 treated urban wastewater samples, 87% of 16 hospital wastewater samples and 85% of 20 pigs' faeces (Kotzamanidis et al. 2009)! The surprisingly high prevalence of VRE outside of the healthcare environment probably relates to the use of vancomycin in veterinary healthcare.

2. *C. difficile*: national US prevalence

C. difficile continues it's siege of the USA, judging by the results of a national point prevalence survey (Jarvis et al. 2009). The prevalence of *C. difficile* was 13.1 per 1000 patients and 82% of hospitals reported that their incidence of *C. difficile* had not decreased in the past three years. Given that the methods used to detect *C. difficile* have poor sensitivity, true prevalence is likely to be substantially higher!

3. *C. difficile*: virulence and supershedding

One of the hallmarks of the NAP-1 / 027 strains has been severe disease. However, a recent US study of 236 *C. difficile* cases found that NAP-1 strains were not associated with more severe diseases than non-NAP-1 strains (Cloud et al. 2009). This suggests that the severity associated with the NAP-1 strain may be more related to its outbreak potential rather than virulence.

So, what explains the outbreak potential of the NAP-1 strain? An interesting study of *C. difficile* disease in an animal model reports that antibiotic exposure of mice experimentally infected with *C. difficile* results in a "supershedder" state (Lawley et al. 2009). Could it be that the NAP-1 strains is a super-supershedder?

4. MRSA and *C. difficile* in long-term care facilities

The USA300 strain has evolved from a common cause of community-acquired infection to a common cause of both hospital and community-acquired infection. A recent study demonstrates that USA300 is now beginning to affect residents of long-term care facilities (Tattevin et al. 2009). The prevalence of USA300 MRSA increased from 11% of all MRSA isolates in 2002 to 64% in 2006, and exhibited a clinical association with skin and soft tissue infection. MRSA is not the only problem in these facilities: an Irish study found that 10% of residents were asymptomatically colonized with *C. difficile*

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(Ryan et al. 2009). These studies raise questions about the adequacy of infection prevention and control in long-term care facilities.

5. Bacterial contamination: stethoscopes and pugs!

A study from a London hospital identified pathogenic bacteria including resistant *Acinetobacter*'s and MRSA from 8% of 22 personal stethoscopes and 14% of 24 bedside stethoscopes (Whittington et al. 2009). MRSA was cultured from a stethoscope earpiece both before and after cleaning.

Pet therapy dogs provide several benefits to patients such as companionship and a reminder of home. However, a recent Canadian study suggests that pet therapy dogs may become reservoirs for transmission (Lefebvre and Weese 2009). The paws of all 26 dogs tested were negative prior to visitation, but one dog acquired *C. difficile* on its paws during its visit. Furthermore, the hands of an investigator were found to be contaminated with MRSA after petting a Pug during a visit.

It seems that both animate and inanimate object continue to provide reservoirs for transmission!

6. Is it really clean? Monitoring hospital cleaning

Hospital cleaning has received much attention in recent years, but remains difficult to evaluate objectively. Rapid detection of ATP on surfaces provides a measure of surface hygiene. A recent US study demonstrates through ATP analysis and culture that daily cleaning is not effective for removing MRSA and VRE contamination; 24% and 16% of 100 surfaces remained contamination with MRSA and VRE, respectively, following daily cleaning (Boyce et al. 2009). The study goes on to show that the efficacy of cleaning, as measured by ATP analysis, is improved significantly by education of the cleaning team, suggesting that ATP analysis is a useful training tool.

An Irish hospital conducted a prospective study on the efficacy of four methods for determining the effectiveness of hospital cleaning over 240 assessments of each method in two wards (Sherlock et al. 2009a). According to their respective testing standards, 93.3%, 71.5%, 92.1%, and 95.0% of visual assessment, ATP analysis, aerobic colony count (ACC) and the presence of MRSA considered acceptable or "clean". The visual assessment was the least sensitive method for assessing cleanliness. ACCs are a good indicator of general bio-burden in an environment, however they are slow and do not necessarily relate to potential risk on infection. The use of indicator organism such as MRSA presence is therefore important and chemical tests such as ATP could be useful for providing rapid information about cleaning efficacy.

It's not only the assessment of cleaning that can be improved; materials and methods of cleaning can also be improved. A recent Welsh study highlights the limitations of detergent or disinfectant impregnated surface wipes (Williams et al. 2009). The study showed that both the disinfectant and detergent containing surface wipes became contaminated with staphylococci and were able to spread the contamination to more than eight subsequent

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surfaces! The study recommends that surface wipes are used in a "1 wipe, 1 application per surface" manner.

7. Is routine hydrogen peroxide vapour decontamination feasible?

A study published last year suggested that hydrogen peroxide vapour (HPV) decontamination can reduce the incidence of *C. difficile* infection (CDI) (Boyce et al. 2008). However, HPV decontamination takes longer than conventional cleaning so the feasibility of routine HPV decontamination in the busy healthcare environment has been called into question. A recent study has investigated the feasibility of routine HPV decontamination over 22 months in a busy US hospital (Otter et al. 2009). More than 1500 rooms were decontaminated over the study and the average time for HPV decontamination was 2 hours 20 minutes. Although over 1000 rooms that satisfied the criteria for decontamination were not decontaminated, most of these were missed because they occurred out of hours, suggesting that patient pressure was not the limiting factor. A key editorial published in the same journal issue discusses some of the issues surrounding the renaissance of vapour-phase hospital decontamination (Boyce 2009).

8. Tasty spores?

Several studies published over the past few months have investigated *C. difficile* contamination of retail food:

- 42% of 88 cooked and uncooked meat samples in the USA (Songer et al. 2009);
- 12% of 230 beef and pork samples in Canada (Weese et al. 2009)
- 7.5% of 40 ready to eat salads in Scotland (Bakri et al. 2009);

Another study identifies a possible seasonality on the prevalence of *C. difficile* in retail meat (Rodriguez-Palacios et al. 2009). It is tempting to speculate that seasonal variation of *C. difficile* in food may influence seasonal variation in human CDI!

9. MRSA contamination in hospitals

Environmental detection of MRSA on surfaces can take up to three days. In certain circumstances, rapid identification of MRSA on surface may be advantageous. PCR based methods have proven unsuitable for this purpose because they do not determine viability of environmental bacteria resulting in poor positive predicative values (Otter et al. 2007). A recent Irish study investigated the use of a rapid culture based method, which can detect MRSA from clinical specimens in two hours (Sherlock et al. 2009b). However the system did not perform well for the detection of environmental MRSA, detecting only 7.5% of positive MRSA samples in the 2 hour incubation period specified for clinical samples. However, the system did detect all of the MRSA with an extended incubation of 16 hours, albeit at the expense of specificity. It may be possible to adjust the formulation of the kit to be used for rapid environmental detection.

It is generally well accepted that patients infected with MRSA contaminate the hospital environment more than those patients who are only colonised (Boyce

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et al. 1997;Boyce et al. 2007). However, a recent study has challenged this position by showing that patients identified through active surveillance cultures are as likely as patients identified by clinical cultures to contaminate their environment, which reinforced the need to isolate both colonised and infected patients.

10. What are you taking home from work?

The dynamics between pathogens from hospital patients, staff and the home environment are not well described. Several studies over the past few months have investigated this dynamic. An Israeli team investigated bacterial contamination on personal handbags of hospital staff (Dotan et al. 2009). Bacteria were cultured from 41% of the 65 bags, including *Acinetobacter baumannii* from one bag, an ESBL-producing *Klebsiella pneumoniae* from one bag and MSSA from two bags, suggesting that staff handbags provide a previously unrecognised reservoir for pathogens.

A Polish study investigated contamination of air in the home environment with methicillin-resistant coagulase-negative staphylococci (MR-CNS) (Lis et al. 2009). A significantly higher proportion of MR-CNS were contaminating the air in the homes of patients with hospital contact, suggesting that exposure to healthcare is a selective pressure for the acquisition of MR-CNS.

Another study investigating contamination of the home environment identified hospital pathogens on commonly touched household surfaces, including Enterobacteriaceae, *Pseudomonas*, MSSA (found in 97% of the 35 homes surveyed) and MRSA (found in 25% of the homes). (Scott et al. 2009). The presence of a cat was a strong predictor for the presence of MRSA and, surprisingly, MRSA was isolated from homes without a history of infections or antibiotic use.

11. And finally…*Acinetobacter* the survivor!

Acinetobacter baumannii has become a common and important cause of multiply drug resistant infections in intensive care units. *A. baumannii* has caused ongoing outbreak that have been attributed to its ability to survive on surface for months on end. A recent study of bacteria surviving in the extremes of temperature, salinity and UV exposure in the Andean lakes has identified *Acinetobacter* sp. as one of the most resistant Genera, confirming its “extremophile” status and explaining why its healthcare-associated cousins have such an ability to survive in the relative benign hospital environment! (Ordonez et al. 2009)

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