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Vancomycin Resistant Enterococci (VRE) – A Brief Review

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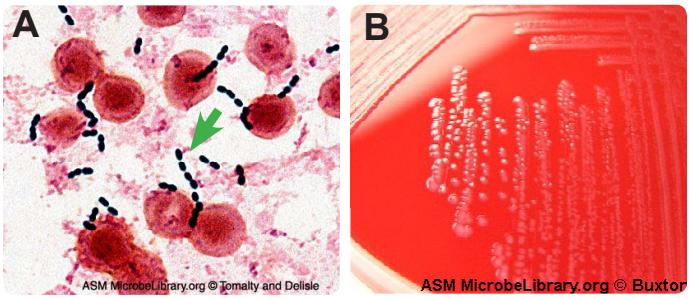
Introduction

Bacteria belonging to the genus *Enterococcus* are part of the normal flora of the human gastrointestinal tract [1]. On Gram stain, enterococci appear in pairs and short chains (Figure 1) [1, 2]. They grow well on routine microbiological media, and are generally either non-hemolytic or alpha-hemolytic on blood agar [1]. *Enterococcus faecalis* makes up approximately 80 to 90% of enterococcal isolates recovered in the clinical microbiology laboratory [1]. *Enterococcus faecium* accounts for an additional 5 to 10% of isolates [1]. Other Enterococcal species are infrequently recovered but these are generally of limited clinical importance.

Figure 1: Enterococcus faecalis in a blood culture; A) Gram-positive cocci in pairs and short chains (arrow), B) Non-hemolytic colonies on blood agar [8, 9]

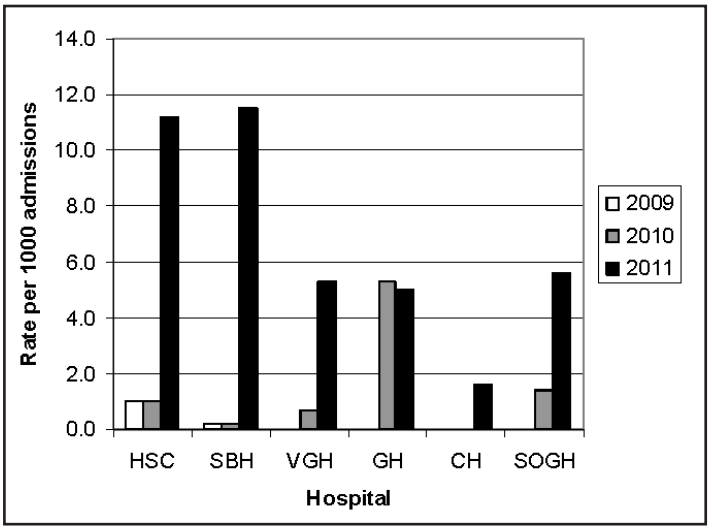


Vancomycin resistant enterococci (VRE) refers to enterococci that demonstrate reduced susceptibility to the glycopeptide antimicrobial vancomycin, resulting from a change in the vancomycin target site [1, 2]. The designation VRE is specifically used for *E. faecalis* or *E. faecium* isolates that have acquired resistance to vancomycin [3]. Other species of *Enterococcus* exist that intrinsically demonstrate low-level resistance to this antimicrobial (*E. casseliflavus*, *E. gallinarum*) [1, 2]. These species are not included in the definition of VRE because they typically do not cause outbreaks, and the genes encoding the low-level resistance are not transferable [4].

Winnipeg Regional Health Authority VRE Rates

The rate of VRE in Winnipeg hospitals per 1000 patient admissions over a defined time period (Jan 1 to March 31 for 2009 to 2011) is presented in Figure 2 [5]. For comparison, the VRE rate in Canada was 5 per 1000 patient admissions in 2009 (CNISP data – no data available for later years) [5]. At the time of writing, the Health Sciences Centre, St. Boniface Hospital, Concordia Hospital and Grace Hospital are reporting ongoing VRE outbreaks.

Figure 2: VRE rate per 1000 hospital admissions (January 1 - March 31)



HSC = Health Sciences Centre, SBH = St. Boniface Hospital, VGH = Victoria General Hospital, GH = Grace Hospital, CH = Concordia Hospital, SOGH = Seven Oaks General Hospital

Clinical Significance

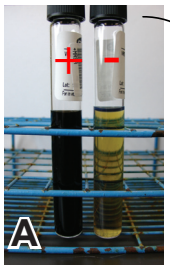
Most VRE isolates recovered in the clinical microbiology laboratory are from screening specimens (e.g. rectal swabs), and detection of the isolate reflects colonization as opposed to active infection [3]. However, enterococci are capable of causing a spectrum of illness that includes urinary tract infections, wound infections, intra-abdominal infections (frequently polymicrobial), bacteremia, and endocarditis [1]. Infections with enterococci tend to occur among elderly and/or immunocompromised patients with serious underlying disease who have been hospitalized for prolonged periods and have invasive devices or have received prior antibiotics [1].

Transmission

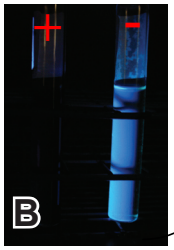
Transmission of VRE may occur by direct contact (e.g. on the hands of healthcare workers) and indirectly from contaminated environmental surfaces [1]. For guidance on infection control precautions, the reader is referred to the WRHA Infection Prevention and Control Manual [6].

over...

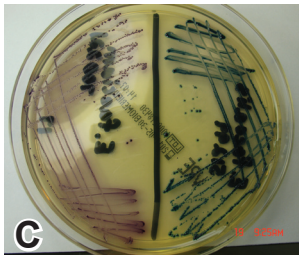
Figure 3. DSM Laboratory Identification of VRE.



Not Fluorescent Fluorescent



Black, non-fluorescent broths are subcultured to chromogenic media



Report as VRE

Rectal swabs are inoculated into enrichment broth for the recovery of VRE. The presence of VRE is indicated by the development of a black pigment (A) and a loss of fluorescence (B). Black, non-fluorescent broths are subcultured onto chromogenic media. On the chromogenic media, *E. faecium* VRE colonies appear purple (left) while *E. faecalis* VRE colonies appear blue (right) (C). VRE are reported based on the growth and colony colour detected on the chromogenic media.

Table 1. Antimicrobial susceptibility of E. faecalis and E. faecium isolates recovered at the Health Sciences Centre (HSC) in 2010

Organism (number tested)	Percent Susceptible					
	Ampicillin	Vancomycin[a]	High-level gentamicin synergy[b]	High level streptomycin synergy[b]	Linezolid	Nitrofurantoin[c]
E. faecalis (n = 111)	96	100	71	77	95	99
E. faecium (n = 52)	6	54	94	58	98	2

no data

a High vancomycin resistance for *E. faecium* is related to a VRE outbreak at HSC in 2010
b Susceptibility to high-level gentamicin or high-level streptomycin indicates that these agents can be used in combination with a cell wall active agent (e.g. ampicillin or vancomycin) for synergy. Gentamicin and streptomycin should never be used alone as treatment for *E. faecalis* or *E. faecium*.
c Nitrofurantoin is indicated for the treatment of cystitis only.

References

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The Clinical Microbiology Discipline has put together a fact sheet on Clostridium difficile for health care workers and patients. It can be accessed at the following link: http://www.dsmanitoba.ca/professionals/microbiology.html

Laboratory Detection

Enterococci are easily recovered from clinical specimens using standard microbiology protocols. Detection of VRE colonization of the gastrointestinal tract is more difficult due to the presence of other normal flora. DSM Clinical Microbiology Laboratories have recently introduced a new VRE screening method to improve both sensitivity of detection and turn-around-time [7]. The recommended specimen for VRE screening is a rectal swab. Upon arrival in the microbiology laboratory, an enrichment broth is inoculated with the swab [7]. After overnight incubation, the broth is examined for turbidity, presence of a black pigment, and loss of fluorescence, all of which suggest the growth of VRE (Figure 3) [7]. Broth that is turbid or black, and non-fluorescent is subcultured to chromogenic VRE media. VRE will grow on the chromogenic media and the specific species can be identified by the colony color, while the growth of other bacteria is inhibited. *E. faecium* (VRE) colonies appear purple on the chromogenic agar, while *E. faecalis* (VRE) colonies appear blue (Figure 3) [7]. The turn-around-time for the new protocol is 48 hours compared to the previous protocol that required 3 to 5 days.

Antimicrobial Susceptibility

The antimicrobial susceptibility profile of *E. faecalis* and *E. faecium* sterile site clinical isolates recovered at the Health Sciences Centre in 2010 is presented in Table 1. As these results are only based on data from the Health Sciences Centre, they may not be reflective of the resistance rates elsewhere in the province. Note that enterococci are intrinsically resistant to many antimicrobials, including cephalosporins, clindamycin, and trimethoprim-sulfamethoxazole. Isolates of *E. faecalis* are usually susceptible to ampicillin, while *E. faecium* isolates tend to be resistant to this antibiotic. Most of the VRE isolates recovered in Winnipeg are *E. faecium*.

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Results That Matter

DSM's vision is to deliver a centrally managed diagnostic system for Manitoba that is sustainable, state-of-the-art, cost-effective and known for its excellent customer service.

DSM Clinical Microbiology Discipline

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