# Assignment: Detection of Vancomycin-resistant Enterococci (VRE)

Answers

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# Clinical case 1

- A 36 year-old male patient with myeloid leukemia presents in the ER with severe symptoms of pneumonia. He is admitted in the ICU. The sputum sample yields *E. faecium*.

- What AB treatment would you recommend?
- Would you consider recommending Daptomycin?
- Why? Why not?

# Case 1

- What AB treatment would you recommend?

- Answer: A 36-year-old immunocompromised male with myeloid leukemia and severe pneumonia caused by *E. faecium* should receive empirical treatment with linezolid

# Case 1

- Would you consider recommending Daptomycin?

- Answer: No, **daptomycin is not recommended** for this patient's *E. faecium* pneumonia.

# Case 1

- Why? Why not?

- Answer:
- **Poor Lung Penetration**: Daptomycin is inactivated by pulmonary surfactant, achieving subtherapeutic levels in lung tissue.

- **Lack of Evidence**: No proven efficacy for VRE pneumonia in clinical studies.

# Case 2

| antibiotic | MIC (mg/L) | CLSI | EUCAST |
|---|---|---|---|
| Ampicillin | > 16 | R | R |
| Gentamicin | > 64 | R | R |
| Gentamicin 120 | > 500 | R | R |
| Erythromycin | > 16 | R | NA |
| Ciprofloxacin | > 16 | R | NA |
| Moxifloxacin | > 8 | R | NA |
| Linezolid | 2 | S | S |
| Tetracycline | 8 | I | NA |
| Teicoplanin | > 64 | R | R |
| Vancomycin | > 64 | R | R |
| Daptomycin | 1 | S | NA |

- What is the type of resistance to vancomycin?

# Case 2

What is the type of resistance to vancomycin?

Answer:

Type of Vancomycin Resistance:

- High-level resistance (MIC >64 mg/L for both vancomycin and teicoplanin).
- Pattern: Resistant to vancomycin (MIC >64) + teicoplanin (MIC >64) → Consistent with vanA-mediated resistance.

Responsible Gene: *vanA*

- Why?
  - *vanA* confers high-level resistance to both vancomycin and teicoplanin (as seen here).
  - *vanB* would show vancomycin resistance (MIC >4) but teicoplanin susceptibility (MIC ≤2), which is not the case here.
  - *vanC* (intrinsic in *E. gallinarum/casseliflavus*) causes low-level resistance (MIC 4–32) and is species-specific.

# Case 3

- *E. gallinarum* was isolated from a rectal swab with the following AB pattern:

| antibiotic | MIC (mg/L) | CLSI | EUCAST |
|---|---|---|---|
| Ampicillin | 1 | S | S |
| Gentamicin | 2 | S | S |
| Gentamicin 120 | < 128 | S | S |
| Erythromycin | 0.5 | S | NA |
| Ciprofloxacin | 1 | S | NA |
| Moxifloxacin | 0.5 | S | NA |
| Linezolid | 2 | S | S |
| Tetracycline | 1 | S | NA |
| Teicoplanin | < 0.5 | S | S |
| Vancomycin | 8 | I | R |
| Daptomycin | 1 | S | NA |

What is the type of resistance to vancomycin?

# Case 3

- What is the type of resistance to vancomycin?

Answer:

Type of Vancomycin Resistance:

- Low-level resistance (Vancomycin MIC = 8 mg/L, intermediate per CLSI, resistant per EUCAST).
- Teicoplanin susceptibility (MIC <0.5 mg/L) → Rules out vanA/vanB.

Responsible Gene: *vanC*1

Why?

- *E. gallinarum* carries intrinsic *vanC*1, which confers low-level vancomycin resistance (MIC typically 4–32 mg/L) but teicoplanin susceptibility.
- vanA/vanB are acquired and cause high-level resistance (MIC ≥64 mg/L to both drugs).
- Cannot be *vanC2/C3* since they are found in *E. casseliflavus* (pigmented, motile).

# Case 4

- An *Enterococcus* isolate is vancomycin-resistant (MIC = 32 µg/mL), L-arabinose (–), and non-motile.

- What is the MOST likely species?
- Why?
- What additional test is MOST useful to confirm Species?
- Why is PCR for *vanA/vanB* recommended after biochemical tests?

# Case 4

- **What is the MOST likely species?**

**Answer:**

**Most Likely Species: *Enterococcus faecium***

- **Rationale:**
  - *E. faecium* is **L-arabinose (–)** and **non-motile**.
  - Other species (e.g., *E. faecalis*) are typically vancomycin-susceptible unless acquired resistance is present.

# Case 4

- **Why?**

- **Answer: Rationale:**
  - *E. faecium* is **L-arabinose (–)** and **non-motile**.
  - Other species (e.g., *E. faecalis*) are typically vancomycin-susceptible unless acquired resistance is present.

# Case 4

- **What additional test is MOST useful to confirm Species?**

Answer:

Some examples of additional tests are as below

- **PCR for *vanA/vanB*** to identify the resistance gene.
- **Teicoplanin MIC**:
  - If **resistant** → *vanA* likely.
  - If **susceptible** → *vanB* likely.
- **MALDI-TOF**
- **WGS**

# Case 4

- **Why is PCR for *vanA/vanB* recommended after biochemical tests?**

**Answer**

1. **Definitive Identification of Resistance Mechanism:**
    1. Biochemical tests (e.g., L-arabinose, motility) only identify the **species** (*E. faecium* vs. *E. gallinarum/casseliflavus*).
    2. **PCR detects the specific resistance genes** (*vanA/vanB*), confirming whether resistance is:
        1. **Acquired** (high-risk, transferable via plasmids/transposons).
        2. **Intrinsic** (low-risk, chromosomal *vanC* in *E. gallinarum/casseliflavus*).
2. **Clinical and Infection Control Implications:**
    1. ***vanA/vanB***: Requires **strict contact precautions** (risk of nosocomial outbreaks).
    2. ***vanC***: No special isolation needed (intrinsic, non-transferable).
    3. Misidentification can lead to unnecessary precautions or missed outbreaks.
3. **Guides Treatment Decisions:**
    1. ***vanA***: Resistant to **both vancomycin and teicoplanin**.
    2. ***vanB***: Resistant to vancomycin but **may respond to teicoplanin**.
    3. Biochemical tests cannot predict these differences.
4. **Limitations of Biochemical Tests:**
    1. **False Negatives:** Rare *vanA/vanB* strains may phenotypically resemble *vanC*.
    2. **False Positives:** Some *E. gallinarum/casseliflavus* may appear resistant on agar but lack epidemic potential.
5. **Gold Standard for Surveillance:**
    1. PCR/WGS tracks **outbreak strains** (e.g., *vanA*-positive *E. faecium* ST117).
    2. Biochemical tests cannot assess clonality or plasmid spread.