Resistant gram-negative bacilli: A neglected healthcare crisis?

Article 204-999-07-011-H01P
Qualifies for 2.0 hours (0.20 CEUs) of continuing-education credit

Learning objectives
After studying this article, the reader should be able to:

1. Identify the prevalence of resistant gram-negative bacilli.
2. Discuss the impact of resistant gram-negative bacilli on the clinical spectrum of nosocomial infections.
3. Explain the barriers to and problems with antimicrobials stewardship programs.
4. List the most commonly used approaches for containing serious infections due to gram-negative bacilli based on pharmacokinetic and pharmacodynamic principles.

Self-assessment questions
For each question there is only one best answer.

1. The epidemiological study conducted at the Hospital of the University of Pennsylvania found that between 1999 and 2003, the proportion of primary healthcare-associated bloodstream infections caused by gram-negative bacteria increased by nearly ______ %.
   a. 10.
   b. 16.
   c. 25.
   d. 30.

2. Data from the National Healthcare Safety Network indicate that between 1998 and 2002, resistance of P. aeruginosa to the quinolones and 3rd-generation cephalosporins approached ______ %.
   a. 20.
   b. 25.
   c. 30.
   d. 35.

3. A study that included 52,637 isolates of P. aeruginosa collected from 1999 to 2003 estimated that nearly one ______ were multi-drug resistant.
   a. Tenth.
   b. Quarter.
   c. Third.
   d. Half.

4. An outbreak of Pseudomon as that affected 231 patients was traced to
   a. Endoscopes.
   b. Mouth swabs.
   c. Tongue depressors.
   d. Toothbrushes.

5. Results of one study showed that of 192 healthy volunteers, nearly ______ in ten carried Acinetobacter species at one of more body sites.
   a. One.
   b. Two.
   c. Three.
   d. Four.

6. The NNIS showed that between 1986 and 2003, the proportion of pneumonia cases in the ICU caused by Acinetobacter species increased by ______ %.
   a. 3.
   b. 4.
   c. 6.
   d. 7.

7. Fournier & Richet documented that a majority of 86 outbreaks associated with A. baumannii from 1990 to 2004 involved
   a. Neurosurgery units.
   b. Neonatal ICUs.
   c. Adult ICUs.
   d. Burn centers.

8. Since the emergence of extended-spectrum β-lactamase (ESBL)-producing Enterobacteriaceae in the 1980s, their prevalence has
   a. Declined.
   b. Remained the same.
   c. Increased slightly.
   d. Increased markedly.

9. Cassettari et al. documented a six-month outbreak of extended-spectrum β-lactamase-producing Klebsiella pneumoniae in an intermediate-risk neonatal unit. The outbreak was linked to:
   a. A ventilator.
   b. A healthcare worker.
   c. Suctioning equipment.
   d. Infusion pumps.

10. Limited data suggest that virulence factors and invasive disease are more common among
    a. Antimicrobial-resistant strains.
    b. Antimicrobial-susceptible strains.
    c. Gram-negative resistant strains.
    d. Gram-negative susceptible strains.

11. The prospective cohort study by Ibrahim and colleagues found that the strongest risk factor for mortality was
    a. Inadequate antimicrobial therapy.
    b. Acquired organ system derangements.
    c. Vasopressor use.
    d. A higher APACHE II score.
12. The retrospective cohort study by Hyle, Lipworth, & Zaoutis found a ______ difference in mortality rates between hospitalized patients who received antimicrobial therapy within 24 hours of culture compared to those who received therapy within 72 hours of culture.
   a. 5.3%.
   b. 8.6%.
   c. 10.3%.
   d. 13.9%.

13. A clinical pharmacist teamed with an infectious diseases physician could initiate the beginnings of an intervention strategy by:
   a. NHSN.
   b. ASP.
   c. IDSA.
   d. SHEA.

14. The study conducted by Caring et al. in Boston measured antimicrobial use according to the ______ method.
   a. Days of therapy.
   b. Defined daily dose.
   c. Grams of use.
   d. SHEA.

15. After implementation of the prospective audit, intervention, and feedback strategy in the Boston hospital, the incidence of vancomycin-resistant enterococci (VRE) and methicillin-resistant *Staphylococcus aureus* (MRSA) ______.  
   a. Decreased.
   b. Remained the same.
   c. Increased.

16. Radical changes in formulary that shift resistance to new, non-restricted agents represents a phenomenon called
   a. Modifying the risk factors.
   b. Inadequate antimicrobial therapy.
   c. Interrupted time series.
   d. Squeezing the balloon.

17. The method of assessing the statistical significance of changes in rates of resistance according to the number of new patients with a resistant isolate per 1000 discharges is a method that is considered to be:
   a. No longer optimal.
   b. More complex but more reliable for most studies.
   c. Valid only for large studies.
   d. Invalid in most cases.

18. ______ makes it impossible to know the causes of subsequent changes in resistance measures.
   a. Using non-permanent chart notes.
   b. Relying on education versus restriction.
   c. Expressing antimicrobial use as grams per month.
   d. Implementing many formulary changes simultaneously.

19. In the study reported by Martin et al. at a Kentucky medical center, resistance was measured as:
   a. The rate of resistant infections.
   b. The incidence of patients infected with the resistant isolate over small intervals – a “time series.”
   c. The proportion of resistant isolates obtained from the hospital antibiogram.
   d. Grams of use.

20. As the measure of choice, IDSA/SHEA guidelines recommend
   a. Grams of use.
   b. Proportion of resistant isolates obtained.
   c. DOT per 1000 patient days.
   d. DDD per 1000 patient days.

21. When change in rates of antimicrobial resistance is the outcome variable and a sufficient number of pre-intervention data points are available, the preferred analysis of intervention investigations, according to the ORION position statement, is:
   a. Rate of resistant infections.
   b. Interrupted time series.
   c. Grams per month.
   d. DDD per 1000 patient days.

22. Antimicrobial interventions have been clearly, convincingly, and consistently documented to favorably impact resistance of gram-negative bacteria.
   a. True.
   b. False.

23. The Carling, Landman, and Martin studies indicate that the optimal antimicrobial strategy:
   a. Has been clearly established.
   b. Is yet to be determined.
   c. Is most efficient for non-urinary infections.
   d. Correlates with the timing of initial therapy.

24. Lautenbach and Polk suggest that with MRSA, the role of antimicrobials is:
   a. Small.
   b. Major.
   c. Insignificant.
   d. Of greater significance than improvements in infection control.

25. In the study by Lipworth et al., the difference in the magnitude of the change in resistance rates between the two Philadelphia hospitals may most likely be attributed to:
   a. Room cleaning.
   b. Training and education.
   c. An effective ASP.
   d. Differences in patient populations.

26. Physicians tend to feel their autonomy is challenged by:
   a. Prospective audit and consultation.
   b. Taking on additional workloads without compensation.
   c. Teaming with pharmacists who have been trained in infectious diseases pharmacotherapy.
   d. Antimicrobial restriction policies.

27. Serum concentrations above the MIC of the infecting organism for approximately 40–50% of dosing interval constitute the major PK/PD parameter for:
   a. β-lactams and erythromycin.
   b. Aminoglycosides and quinolones.
   c. A higher APACHE II Score.
   d. Non-urinary infections.
28. Administering larger doses for concentration-dependent agents or using constant infusions for time-dependent agents would be an example of:
   a. Increasing the diversity of antimicrobial use to decrease resistance, as predicted by mathematical models.
   b. Optimizing dosing strategies to meet PK/PD target attainment values to achieve maximum bacterial killing.
   c. Extending clinical practice beyond the impact of an ASP.
   d. Using segmented time-series regression to statistically influence the slope of a series of data points.

29. Lautenbach & Polk note that the emergence of resistance in nosocomial pathogens might not be due so much to treatments with suboptimal doses as to:
   a. The “innocent bystander” effect.
   b. The “squeezing the balloon” phenomenon.
   c. Demographics.
   d. Formulary restrictions.

30. As the prevalence of multidrug-resistant bacteria increases, ______ remains the cornerstone of infection control and is assuming even greater importance.
   a. Microbiotic surveillance.
   b. The ISDA/SHEA guidelines for ASP.
   c. Appropriate isolation.
   d. Prospective audit, intervention, and feedback.

31. Pittet et al. report that following implementation of an aggressive hand hygiene program at one institution, the rate of nosocomial infections decreased over a four-year period by
   a. 16.9%.
   b. 12.0%.
   c. 9.9%.
   d. 7.0%.

32. The study by Bhalla et al. indicated that gram-negative bacteria and C. difficile were virtually eliminated by:
   a. The use of gloves and gowns.
   b. Patient isolation.
   c. Ceftiraxone.
   d. Room cleaning.

33. In the study by Srinivasan et al. on the use of gowns plus gloves versus gloves alone worn by healthcare workers in the ICU at Johns Hopkins Hospital, it was found that the percentage of patients who acquired VRE was reduced by ______ during the time period when healthcare workers wore both gloves and gowns
   a. 1/4.
   b. 1/3.
   c. 1/2.
   d. 2/3.

34. A limited number of antimicrobial agents are in development, and ______ of them target gram-negative bacteria.
   a. Most.
   b. Many.
   c. Few.
   d. None.

35. It is clear that resistance can be prevented with optimization of the dose in the clinical use of antimicrobials.
   a. True.
   b. False.

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ACPE #: 204-999-07-011-H01P
CE credit: 2.0 hours (0.2 CEU)
Expiration date: December 1, 2010

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