

You are looking up results prior to conducting the intensive care unit ward round when you realise 4 of the 12 patients on the unit have sputum samples with *Pseudomonas aeruginosa* in them and the clinical details for all three say “ventilator associated pneumonia”. Discuss what you would do about these results?

Introduction

Pseudomonas aeruginosa is an aerobic Gram-negative bacillus that thrives in warm moist sites. It can be part of a patient’s normal flora or it can be an environmental organism.

Ventilator Associated Pneumonia is a lower respiratory tract infection occurring 48 hours after initiation of mechanical ventilation.

Is this an outbreak?

An outbreak is defined as two or more cases of a specific infection linked in time, place or person. An outbreak can be a single infection if it is sufficiently rare e.g. Ebola in the UK.

Four cases of VAP caused by *P. aeruginosa* is an outbreak as these cases are specific and linked in time and place. At this stage it is not possible to say whether this is an outbreak of VAP or an outbreak of *P. aeruginosa*; either is possible. Double check all the cases are real and there have been no errors in laboratory testing.

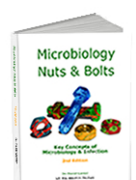
An outbreak should be declared and the relevant people notified including:

- Infection control team (ICT)
- Director of Infection Prevention and Control (DIPC)

Call an outbreak meeting

As soon as an outbreak is declared start to arrange a meeting of the outbreak control group; it takes time to bring everyone together so the sooner this is started the better. People to invite include:

- ICT – nurses, doctor (ICD) and secretarial support for minute taking
- DIPC
- Microbiologist and Senior Biomedical Scientist if available (may need to undertake enhanced surveillance and laboratory need to be involved)
- ICU head of service and ward manager (or their senior representatives) who will know their patients and their unit practices
- ICU pharmacist or Antimicrobial Pharmacist in case there are problems with antibiotic prescribing or there needs to be a temporary change in formulary/guidelines for ITU
- Physiotherapy representative – will have insight into management of individual patients
- Consultant in Communicable Disease Control (CCDC) as there may be public health implications
- Medical Director or Divisional Lead for ITU
- Chief Executive or their representative
- Director of Nursing or patient services to manage nursing issues
- Estates manager – to bring details of any recent building or plumbing work and latest water testing results
- Decontamination lead for the Trust to report on any equipment



decontamination failures

- Domestic supervisor responsible for cleaning the unit – a deep clean may be required as well as potential for cleaning equipment to be the root cause
- Occupational Health representative in case there are staff related issues
- Communications manager to prepare and hold a public statement

Interim control measures pre-outbreak meeting

Ensure patients on correct treatment for any infections.

If any potential source of infection identified straight away either correct or quarantine as appropriate.

Outbreak Control Group (OCG) Meeting

DIPC or ICD to chair the meeting.

Set an agenda and stick to it:

- **Background** to outbreak and why meeting
- **Confirm cases** and discuss relevant history of each patient
- **Case finding** – are there any patients known to ITU that have not been detected yet but are part of the outbreak
- **Examine descriptive epidemiology** of cases including time-line of patients on unit, potential for cross infection, pay particular attention to common pieces of equipment, members of staff, location in the unit, clinical teams, procedures, antibiotics
- Review recent hand hygiene and antibiotic audits
- Review recent estate issues including building work and water testing
- Review decontamination records for common equipment
- **Generate a hypothesis** for cause of outbreak
- Decide on **actions to protect patients** from potential harm e.g. closing beds, disconnecting water outlets, using bottled water, buddying up nurses for airway care, deep-clean the unit, etc.
- Decide on **plan for testing hypothesis** including laboratory testing
- Decide on **communications** to patients, relatives, staff on ITU and generate a press statement to release if enquiries received from the media
- Arrange to **reconvene the OCG** to discuss findings and review actions, usually 48 hours later at least to allow time to address problems

Generating a hypothesis

A hypothesis should take into account potential causes of both P. aeruginosa infection as well as VAP. At this stage there is no proof of either outbreak. Even if the bacterial isolates look the same in the laboratory this will need confirming by pulse-field gel electrophoresis (PFGE) at a reference laboratory and this will take time. Talking to the ref. lab. will expedite this but the investigation should continue in the meantime.

Potential causes of outbreak

The potential sources of infection, or contributing factors to infection, with P. aeruginosa that need considering or investigating include:

- Water supply to the unit, either in the water itself or the water outlet (sink, faucet, etc.)
- Excessive antibiotic usage selecting this bacterium out of patients normal flora
- Cross infection from

- Patient-to-patient – mobile patients or patients who are difficult to manage on the unit, staffing levels
- Patient-to-staff-to-patient – hand hygiene
- Patient-to-equipment-to-patient e.g. bronchoscopes, ventilators, laryngoscopes, suction equipment,
- From environment-to-patient – sinks, faucets, wash bowls, etc.
- Respiratory tract care
 - Suctioning, mouth washing, handling the endotracheal tube or tracheostomy

The potential causes or contributing factors to VAP that need considering or investigating include:

- Excessive antibiotic usage selecting this bacterium out of patients normal flora
- Respiratory tract care
 - Suctioning, mouth washing, handling the endotracheal tube or tracheostomy
- Patient factors – high risk patients for VAP e.g. chest trauma, morbid obesity, high ventilator requirements with associated barotrauma

The most likely cause – main hypothesis

Pseudomonas aeruginosa is being transmitted from an environmental water source via poor respiratory tract care or poor hand hygiene. This is being exacerbated by excessive antibiotic usage.

Investigation of hypotheses

- Screen upper respiratory tract of all patients to detect other cases
- Review old microbiology reports going back at least 4 weeks for other cases
- Review hand hygiene compliance and observe practice in real time
- Environmental sampling of water sources and all moist sites which might harbour *P. aeruginosa* (sinks, faucets) and also equipment (test sample bronchoscopes, ventilator circuits, etc.)
- Review and monitor antibiotic usage with weekly spot check audits to check compliance with empirical guidelines on ITU

Control measures

Whilst the outbreak is being investigated control measures can be implemented to control all of the potential causes of the outbreak including those of the main hypothesis.

- Infection control
 - Isolate cases and use standard precautions e.g. gloves and gowns for patient contact (if insufficient side-rooms then consider cohorting cases together)
 - If ongoing cases without obvious source consider whether to fully or partially close the unit to new admissions
- Enhanced surveillance
 - Screen upper respiratory tract of patients weekly to detect future cases
 - Laboratory to send away all *P. aeruginosa* isolates from ITU for typing with reference to the outbreak
- Patient care
 - Ensure adequate staffing levels and if necessary increase staffing numbers

- Increased ICT presence observing nursing and medical practice on ward with particular emphasis on hand hygiene and respiratory care
 - Ensure sterile bottled water is used for all mouth and respiratory tract care
- Estates
 - Repeat and regularly test (weekly) water samples from ITU sentinel points
 - Review all water sources including sinks and faucets
- Deep clean the ITU
- Reprocess and decontaminate all airway related equipment e.g. bronchoscopes, ventilators, etc.

Communications

Communicate with patients, relatives and staff explaining what is happening and what is being done to address the issues and protect patients.

Draft a press statement but do not release this until asked for it by the media as this can help control access for information without unsolicited calls to the ITU.

Write a report and close the outbreak

Write a report so that lessons can be learnt and future outbreaks prevented. This encourages an organisation with a memory.

