Erysipelothrix rhusiopathiae
Bacteraemia: An Unusual Pathogen

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Introduction

- Principles of Blood Culture Systems.
- Bacteraemia case report.
- Clinical manifestations and bacteriology of the occupational pathogen, *Erysipelothrix rhusiopathiae*. 
Principles of Common Blood Culture Systems

• The principle of all blood culture systems is to encourage the maximum yield of a pathogen present in the blood in as short a time as possible in order to have the greatest influence on patient management, thereby generating the best outcomes.

• By using highly nutritious media and incubation at an optimal temperature rapid growth is obtained.
Principles of Common Blood Culture Systems

• Eventually, the number of organisms in the blood culture will reach a threshold where they can be detected.

• Various detection methods exist and include:
  – Traditional, manual blood culture systems (e.g. Oxoid Signal).
  – Automated blood culture methods, either radiometric or non-radioactive (e.g. BacT/ALERT 3D, BD BACTEC, Thermo Scientific VersaTREK, Biomerieux Virtuo).
Automated Blood Culture Systems

Biomerieux BacT/ALERT 3D

• The BacT/ALERT is a simple, automated rapid microbial detection system that uses colorimetric technology.

• If microorganisms are present in the blood culture, CO₂ is produced as the microorganisms metabolise the substrates in the culture medium.
Automated Blood Culture Systems

• When growth of the microorganisms produces CO$_2$, the colour of the sensor in the bottom of each culture bottle changes from grey to light yellow.

• A light-emitting diode (LED) projects light onto the sensor.

• The light reflected is measured by a photo detector.
Automated Blood Culture Systems

• As more CO₂ is generated, more light is reflected.

• This information is compared to the initial sensor reading.

• If there is a high initial CO₂ content, an unusually high rate of CO₂ production, and/or a sustained production of CO₂, the sample is determined to be positive.
BacT/ALERT 3D blood culture system, the available culture media applicable to the instrument and the patented colorimetric technology. The instrument measures colour changes every 10 minutes. www.biomerieux-diagnostics.com
Bacteraemia Case Report

• 61yr old female with a past medical history of right breast cancer and hypothyroidism presented to A&E at Victoria Hospital Rothesay.

• She was admitted on Saturday 21\textsuperscript{st} November, 2015 with a working diagnosis of sepsis.

• Physical examination revealed infected shingles.

• Blood cultures were drawn on admission and FBC, U&Es, CRP and Glucose were all requested.
## Haematology

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Ref. Range (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Blood Count</td>
<td>10.6</td>
<td>4.0 - 11.0 x10^9/l (x10^9/l)</td>
</tr>
<tr>
<td>Red Cell Count</td>
<td>3.84</td>
<td>3.80 - 5.80 x10^12/l (x10^12/l)</td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>* 114</td>
<td>115 - 165 g/l (g/l)</td>
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<tr>
<td>Haematocrit</td>
<td>* 0.337</td>
<td>0.370 - 0.470 l/l (l/l)</td>
</tr>
<tr>
<td>Mean Cell Volume</td>
<td>87.8</td>
<td>80.0 - 100.0 fl (fl)</td>
</tr>
<tr>
<td>MCH</td>
<td>29.7</td>
<td>27.0 - 32.0 pg (pg)</td>
</tr>
<tr>
<td>Platelet Count</td>
<td>* 135</td>
<td>150 - 400 x10^9/l (x10^9/l)</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>* 8.9</td>
<td>2.0 - 7.5 x10^9/l (x10^9/l)</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>* 1.4</td>
<td>1.5 - 4.0 x10^9/l (x10^9/l)</td>
</tr>
<tr>
<td>Monocytes</td>
<td>0.6</td>
<td>0.2 - 0.8 x10^9/l (x10^9/l)</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>0</td>
<td>0.0 - 0.4 x10^9/l (x10^9/l)</td>
</tr>
<tr>
<td>Basophils</td>
<td>0</td>
<td>0.0 - 0.1 x10^9/l (x10^9/l)</td>
</tr>
</tbody>
</table>
## Biochemistry

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Ref. Range (Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>135</td>
<td>133 - 146 mmol/L (mmol/L)</td>
</tr>
<tr>
<td>Potassium</td>
<td>3.8</td>
<td>3.5 - 5.3 mmol/L (mmol/L)</td>
</tr>
<tr>
<td>Chloride</td>
<td>101</td>
<td>95 - 108 mmol/L (mmol/L)</td>
</tr>
<tr>
<td>Urea</td>
<td>3.8</td>
<td>2.5 - 7.8 mmol/L (mmol/L)</td>
</tr>
<tr>
<td>Creatinine</td>
<td>73</td>
<td>40 - 130 umol/L (umol/L)</td>
</tr>
<tr>
<td>Estimated GFR</td>
<td>&gt;60</td>
<td>&gt;60 ml/min (ml/min)</td>
</tr>
<tr>
<td>C Reactive Protein</td>
<td>*17</td>
<td>0 - 10 mg/L (mg/L)</td>
</tr>
<tr>
<td>Glucose</td>
<td>5.2</td>
<td>3.5 - 6.0 mmol/L (mmol/L)</td>
</tr>
</tbody>
</table>
Microbiology

• Blood culture set incubated in the BacT/ALERT 3D system (21/11/2015).

• On Monday 23rd November, bacterial growth was detected in both O2 and AnO2 blood culture bottles.

• CBA, FHB and MHS culture plates inoculated and incubated overnight in CO₂, 36°C.

• Microscopy revealed Gram positive bacilli.
Microbiology

- Very small, α-haemolytic, smooth colonies were cultured on blood agar.

- Analysis of the colonies showed the following characteristics:
  - Gram positive bacilli on repeat Gram film.
  - Catalase negative.
  - Oxidase negative.
Isolate identified by Vitek MS as *Erysipelothrix rhusiopathiae*. 
Microbiology

• As per Microbiology Consultant, Penicillin, Ciprofloxacin and Vancomycin E-tests were set up.

• To confirm the isolate identification, a Gram positive (GP) I.D. card was inoculated using the Vitek 2 system.

• Organism associated with fish and pigs – patient cooked a lot of fish and was previously a sheep farmer.

• Patient was on IV Cefuroxime and Flagyl.
Antibiotic Sensitivity Results

• Using both EUCAST and CLSI criteria the E-tests revealed the following MIC results for this organism:
  • Penicillin 0.12 mg/L.
  • Ciprofloxacin 0.12 mg/L.
  • Vancomycin 32 mg/L.

• To supplement these results, the Microbiology Consultant also requested cephalosporin sensitivity.

• CXM disc zone size 35mm and CRO MIC 0.06 mg/L.
Antibiotic Sensitivity Results
Antibiotic Therapy

• Patient was administered IV antibiotics followed by 2-4 weeks of PO antibiotics.

• PO Cephalexin suggested for 2-4 weeks – better bioavailability.

• Risk of *C. difficile* with this option so advised this should be monitored and reviewed.

• Diarrhoeal stool samples negative for *C. difficile* infection (25/02/2015).
Antibiotic Therapy

• On completion of 2 weeks IV and 2 weeks PO antibiotics, the patient was clinically well and made a full recovery.

• Inflammatory markers normalised and there were no obvious deep sources.

• ECHO requested but Cardiology declined in the absence of murmurs or stigmata of IE.

• Still unclear where organism originated from.
Isolates in NHSGGC

- 80yr old female presented to Glasgow Victoria Infirmary with infected foot ulcer (13/05/2013).
- Wound swab of this area cultured *E. rhusiopathiae*.
- CRP = 246mg/L.
- WBC = 27.9x10^9/l.
- Neutrophils = 25.8x10^9/l.
- Intra-abdominal sepsis with an unrelated necrotic foot ulcer secondary to Peripheral Vascular Disease.
Isolates in NHSGGC

- 2yr old female child presented to the Royal Hospital for Sick Children with neck abscess.
- Pus collected from this abscess cultured *E. rhusiopathiae*.
- CRP = 211mg/L.
- WBC = 22.3x10^9/l.
- Neutrophils = 16.8 x10^9/l.
- Incision and drainage of the abscess. Under the care of ENT.
**Erysipelothrix rhusiopathiae**

- Straight or slightly curved, slender, rod-shaped organism.
- 0.2-0.4μm in diameter and 0.8-2.5μm in length.
- Non-motile, non-sporulating, non-acid-fast facultative anaerobe.
- Occurs in a variety of configurations including short chains, pairs, ‘V’ configuration, and random groups.
**Erysipelothrix rhusiopathiae**

- Based on colonial appearance, *Erysipelothrix* morphology is described as smooth (S) or rough (R).

- **S**-form colonies are convex, with a smooth surface and entire edge.

- **R**-form colonies are larger with an irregular edge and flattened, rough surface.

- **S**-form morphology is typically seen in chronic infections, i.e., arthritis and endocarditis.
Erysipelothrix rhusiopathiae

• *E. rhusiopathiae* is found worldwide and has been reported as a commensal or pathogen in a variety of wild and domestic animals, birds and fish.

• Animal-to-human transmission occurs by direct cutaneous contact (via scratches or puncture wounds).

• Human-to-human infection has not been documented.

• Most human cases are associated with occupational exposure to contaminated meat or fish (fishmonger’s finger).
Pathogenesis & Pathology

- Very little is actually known about the pathogenesis of *E. rhusiopathiae*.

- The organism produces a hyaluronidase and a neuraminidase and it is hypothesised that the level of these enzymes may correlate with virulence.

- IV injection of the pathogen into rabbits is fatal in 2-3 days – erysipeloid rash, lungs become haemorrhagic and a pericardial exudate develops.
Animal Disease

- Domestic swine are believed to be the most important animal reservoir of *E. rhusiopathiae*.

- The organism is shed by diseased animals in faeces, urine, saliva and nasal secretions, which can contaminate food, water, soil and bedding.

- As well as affecting swine, *E. rhusiopathiae* causes poly-arthritis of sheep and lambs, and erysipelas in calves, ducks and domestic turkeys.
Swine Erysipelas

- Acute = septicaemia, fever, anorexia, diarrhoea, cyanosis and death.
- Sub-acute urticarial form = diamond-shaped skin lesions, alopecia, sloughing of tail tip and ear tips, hyperkeratosis.
- Chronic, non-suppurative arthritic form.
- Chronic cardiac form = vegetative endocarditis.
Marine Environments

• Associated with marine fish, molluscs and crustaceans.

• The organism survives and grows on the exterior mucoid slime of fish.

• Doesn’t cause disease in the fish but is thought to be an important source of infection for man.
Clinical Manifestations in Humans

• Infection with *E. rhusiopathiae* can cause three forms of human disease:
  • Localised cutaneous form. (also known as erysipeloid of Rosenbach).
  • Generalised, diffuse cutaneous form.
  • Septicaemia often associated with endocarditis.

• Erysipeloid is the most common form and is an acute localised cutaneous infection, usually cellulitis.

• Typically occurs on the hands or fingers.
Clinical Manifestations in Humans

- Incubation period <4 days.
- Distinctive, well-demarcated.
- Erysipelas begins as a small erythematous patch that progresses to a fiery-red/purple, indurated, tense, and shiny plaque, as shown in the image.
- Local signs of inflammation, swelling, burning or throbbing pain.
Clinical Manifestations in Humans

• The diffuse cutaneous form is more generalised.

• Lesions tend to spread from initial site to other parts of the body.

• Bullous lesions can also occur.

• Systemic symptoms include: fever, malaise, joint & muscle pain and severe headaches.
Clinical Manifestations in Humans

- Bloodstream infections with *E. rhusiopathiae* are not common.

- Bacterial cultures are positive in only 5% of cases.

- A strong association exists between bacteraemia and the development of IE.

- It tends to occur in immunocompromised patients, has a higher male to female ratio and can occur in patients with normal native values as well as prosthetic valves.
Treatment

• Penicillin is the drug of choice.

• Cephalosporins are suitable alternatives in patients allergic to Penicillin.

• *Erysipelothrix* is also highly susceptible to Clindamycin.

• Most strains are resistant to Aminoglycosides, SXT, Sulphonamides, Streptomycin and Vancomycin.
Prevention

• Containment and control.

• Cleaning and disinfection of work surfaces and tools, hand hygiene, and use of gloves reduce the risk of infection when working with animals or animal products.

• Protective apparel should be worn by those working in slaughterhouses or fisheries.

• Control of animal disease – herd management, good sanitation, immunisation.
Thank you!