

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 CO₂, 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.



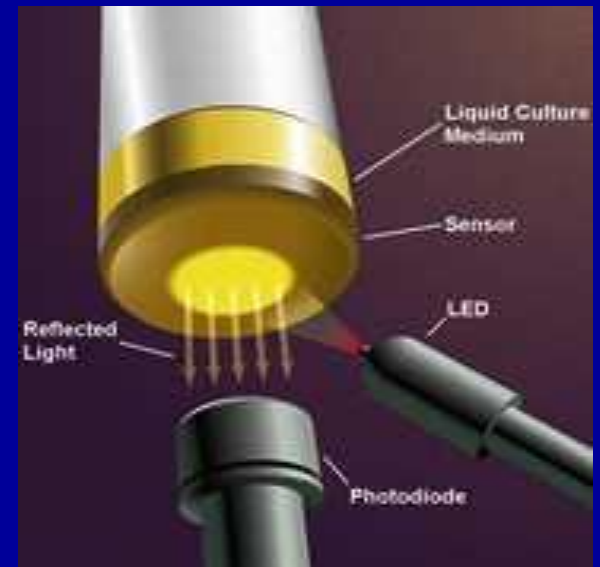
www.biomerieux-diagnostics.com

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 21st 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.



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Haematology

<u>Test</u>	<u>Result</u>	<u>Ref. Range (Units)</u>
White Blood Count	10.6	4.0 - 11.0 $\times 10^9/l$ ($\times 10^9/l$)
Red Cell Count	3.84	3.80 - 5.80 $\times 10^{12}/l$ ($\times 10^{12}/l$)
Haemoglobin	* 114	115 - 165 g/l (g/l)
Haematocrit	* 0.337	0.370 - 0.470 l/l (l/l)
Mean Cell Volume	87.8	80.0 - 100.0 fl (fl)
MCH	29.7	27.0 - 32.0 pg (pg)
Platelet Count	* 135	150 - 400 $\times 10^9/l$ ($\times 10^9/l$)
Neutrophils	* 8.9	2.0 - 7.5 $\times 10^9/l$ ($\times 10^9/l$)
Lymphocytes	* 1.0	1.5 - 4.0 $\times 10^9/l$ ($\times 10^9/l$)
Monocytes	0.6	0.2 - 0.8 $\times 10^9/l$ ($\times 10^9/l$)
Eosinophils	0	0.0 - 0.4 $\times 10^9/l$ ($\times 10^9/l$)
Basophils	0	0.0 - 0.1 $\times 10^9/l$ ($\times 10^9/l$)



Biochemistry

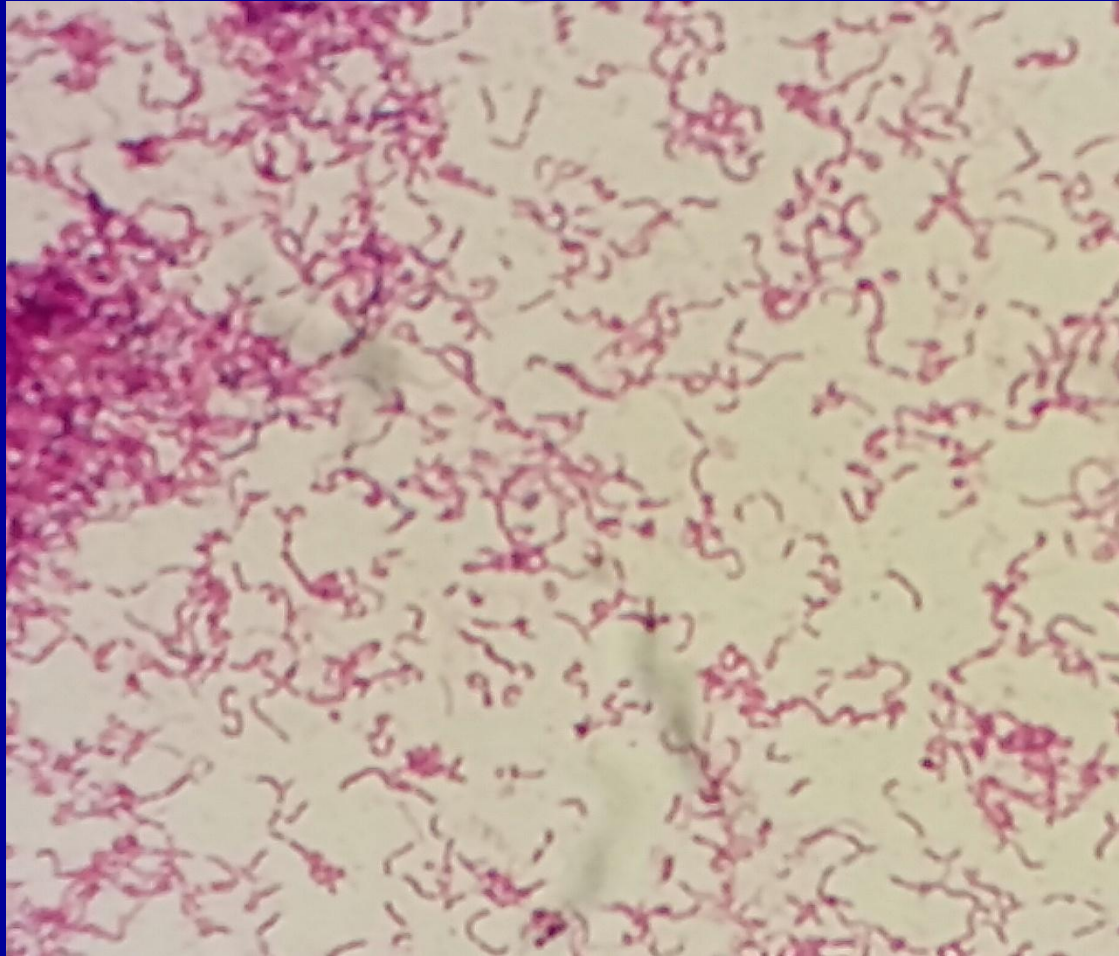
<u>Test</u>	<u>Result</u>	<u>Ref. Range (Units)</u>
Sodium	135	133 - 146 mmol/L (mmol/L)
Potassium	3.8	3.5 - 5.3 mmol/L (mmol/L)
Chloride	101	95 - 108 mmol/L (mmol/L)
Urea	3.8	2.5 - 7.8 mmol/L (mmol/L)
Creatinine	73	40 - 130 umol/L (umol/L)
Estimated GFR	>60	>60 ml/min (ml/min)
C Reactive Protein	*17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

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



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.

Microbiology



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 = $27.9 \times 10^9/l$.
- Neutrophils = $25.8 \times 10^9/l$.
- 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 = $22.3 \times 10^9/l$.
- Neutrophils = $16.8 \times 10^9/l$.
- Incision and drainage of the abscess. Under the care of ENT.

Erysipelothrix rhusiopathiae

- Straight or slightly curved, slender, rod-shaped organism.
- 0.2-0.4 μm in diameter and 0.8-2.5 μm 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 polyarthritis 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.



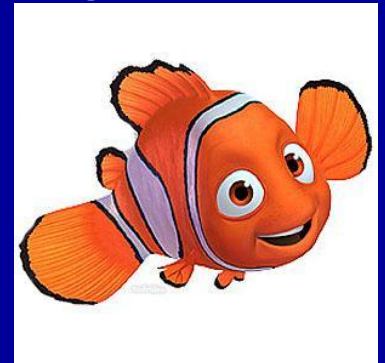
<http://www.nadis.org.uk/bulletins/erysipelas.aspx>



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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 valves 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!