

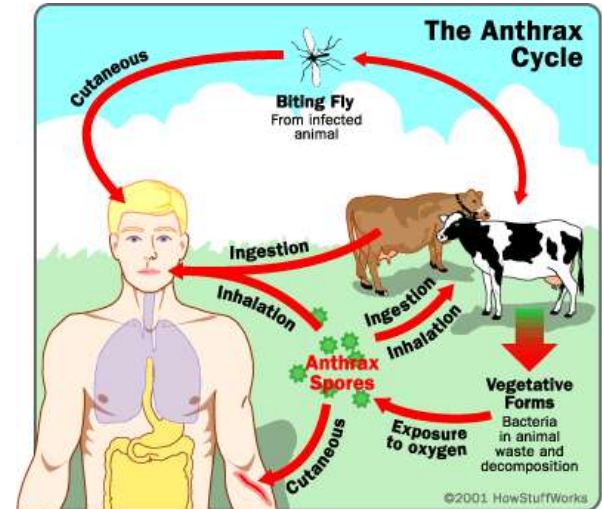
# *Bacillus anthracis* meningitis during an outbreak of injectional anthrax in Scotland

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SMA Free-paper session  
31/10/15

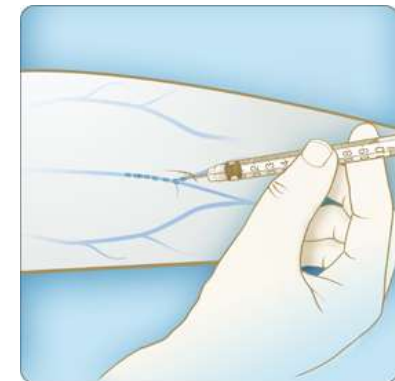
# Bacillus Anthrax

- Zoonotic disease caused by the Gram-positive, spore forming rod *Bacillus anthracis*.
- Transmitted to humans through exposure to animal products (such as hides, wool and hair), direct exposure to anthrax-infected animals or through ingestion of contaminated meat.
- 3 classical forms: cutaneous, inhalational, gastrointestinal.  
New form: injectional.
- Injectional anthrax first case reported in 2000, and since then 70 laboratory-confirmed cases among heroin users in Europe.



**Anthrax Transmission**

Photo from how stuff works: science  
<http://science.howstuffworks.com/anthrax1.htm>



**IV Drug Use**

Photo from CDC  
<http://www.cdc.gov/anthrax/types/injection.html>

# 2009/2010 Scottish Outbreak of Injectional Anthrax

- A single anthrax strain originating from Turkey, suggesting accidental contamination from animal derived sources such as bone meal (a cutting agent) or animal hides.

<b>Health Board</b>	<b>Number of Cases</b>	<b>Number of Deaths</b>
Ayrshire & Arran	1	0
Dumfries & Galloway	6	0
Fife	3	1
Forth Valley	1	1
Greater Glasgow & Clyde	20	7
Lanarkshire	9	2
Lothian	2	0
Tayside	5	2
<b>Totals</b>	<b>47</b>	<b>13</b>

1. Health Protection Scotland (HPS). National Anthrax Outbreak Control Team: An outbreak of anthrax among drug users in Scotland, December 2009 to December 2010. Glasgow: HPS; 2011

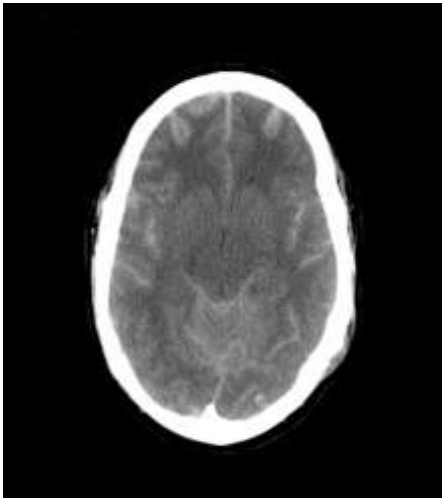
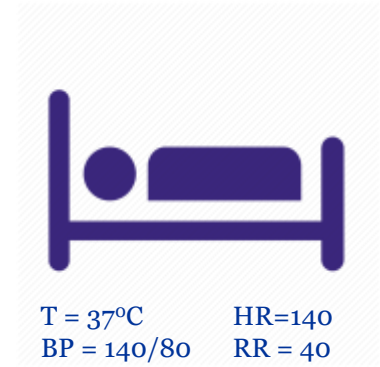
- Three of the thirteen fatal confirmed cases had death attributed to haemorrhagic meningitis on post-mortem examination. <sup>2</sup>

	<u>Case 1</u>	<u>Case 2</u>	<u>Case 3</u>
<u>General</u>			
Age	34 yrs	55 yrs	41 yrs
Sex	Male	Male	Male
Drug Use	IV Heroin	IV Heroin	IV and Inhaled Heroin
<u>Signs and Symptoms</u>			
Neurological	Headache, agitation seizure, GCS 7/15.	Seizure, collapse, reduced tone, positive Babinski's sign GCS 8/15.	Severe confusion, lethargy GCS 3/15.
Skin and Limb	Evidence of IV drug use but no infection at injection sites.	Severe odema and erythema of right arm/axilla, haemorrhage within skin and blister. Cellulitis pretibial area left leg. Evidence of IV drug abuse front of the right forearm.	Evidence of IV drug use as cutaneous marks were present but no evidence of infection. Mottling.
<u>General Observations</u>			
Temperature, °C	36.7	36.5	38.2
Blood pressure, mm Hg	140/80	120/90	116/72
Heart Rate, beats per minute	140	150	72
Respiratory Rate, breaths per min	40	25	36
<u>Blood Results (reference)</u>			
Hb (12-16g/dL)	22.8	21.3	17.3
Haematocrit	ND (not done)	0.572	0.512
PT ratio	1.63	1.5	1.3
Prothrombin Time (sec)	ND	16.1	13.5
Fibrinogen g/l	0.8	ND	2.3
D-dimer	ND	ND	>4900
Platelets (150-144 x10 <sup>9</sup> /L)	77	65	58
White Cell Count, x10 <sup>9</sup> /L (4-11 x10 <sup>9</sup> /L)	10.6	13.3	10.9
Neutrophil count, x 10 <sup>9</sup>	NR (not recorded)	11.1	8.8
Lymphocyte count, x 10 <sup>9</sup>	NR	1.2	1.6
C-reactive Protein, mg/L (<6 mg/L)	21	20	49
Base excess mmol/L	ND	-9	-1
Lactate mmol/L	ND	7.8	10.8
<u>Imaging Results</u>			
Chest radiograph	NR	No consolidation, mediastinal widening or pleural effusions.	No consolidation, mediastinal widening or pleural effusions.
<u>Microbiological Diagnosis</u>			
Blood Culture	ND	Positive after 48 hours	Positive < 24 hours
Blood PCR	ND	Positive	Positive
Blood serology	ND	Anti-PA IgG positive and Anti-LF IgG equivocal	Negative Anti-PA IgG and Anti-LF IgG
Blood	ND	PA and LF positive	PA and LF positive
Brain Tissue	GPR on Gram-stain and PCR positive	ND	ND
Spleen Tissue	PCR positive	ND	ND
Endotracheal aspirate	ND	ND	PCR positive and Culture negative
<u>Antibiotic Therapy</u>	Ceftriaxone	Flucloxacillin	Benzylpenicillin, Clindamycin, Ciprofloxacin
<u>Management</u>	Emergency Department and Intensive Care Unit.	Emergency Department	Emergency Department and Intensive Care Unit.
<u>Outcome</u>	Patient died < 12 hours after admission.	Patient died < 24 hours after admission.	Patient died < 48 hours after admission.

- Case 1 treated at the Victoria Hospital, Glasgow (admitted 12<sup>th</sup> December 2009).
- Cases 2 +3 treated in Ninewells Hospital, Dundee (case 2 admitted 31<sup>st</sup> December 2009, case 3 admitted 6<sup>th</sup> January 2010).

## Case 1, 34 year old man. VH Glasgow.

- 36/24 of severe headache, confusion and agitation.
- Admitted to A&E from home.
- History of occasional cocaine, diazepam, and heroin use. On methadone treatment.
- On examination evidence of injecting drug use, no infection at injection sites was identified.



Case 1: CT HEAD

Extensive subarachnoid blood is present with small occipital haemorrhage. There is also effacement of lateral and third ventricles and slightly reduced attenuation of white matter indicative of early cerebral oedema.

- Whilst in A&E he developed a generalised tonic-clonic seizure. Given IV ceftriaxone as meningitis was suspected.
- Rapidly deterioration, anaesthetised and intubated, transferred to ICU. He died within 12 hrs of admission to hospital.
- The patient's condition did not improve and he died within 12 hours of admission.
- Numerous gram positive bacilli in brain tissue and brain and spleen tissue both PCR positive for *B. anthracis*.

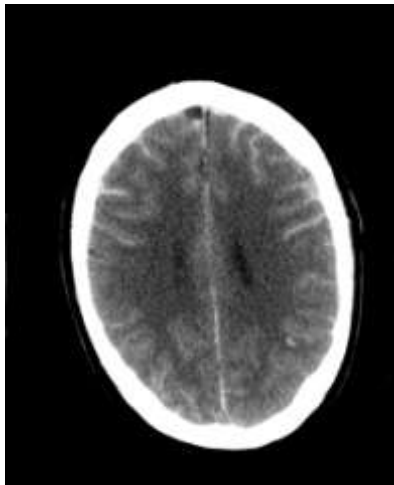
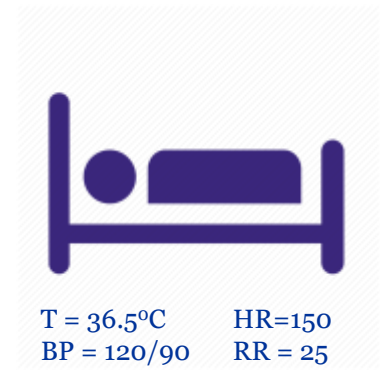


Case 1: Post-mortem examination of brain

Extensive sub-arachnoid blood on image. Global ischaemic neuronal change and normal Circle of Willis evident on further examination.

## Case 2, 55 year old man. NWH Dundee.

- Seizure and collapse.
- Injected heroin 2 days prior to admission and had 3/7 of cellulitis of his right upper limb.
- Resided in a homeless unit and had a history of alcohol excess and CVA.
- On examination cellulitis in right arm and axilla. Evidence of injecting drug use on this arm.



Case 2: CT HEAD

Extensive subarachnoid blood within cerebral sulci and interhemispheric fissure with small subcortical haemorrhages in right frontal lobe and left parietal lobe

- Diagnosis of sepsis due to soft tissue infection . IV Flucloxacillin given, CT head ordered for his neurological symptoms.
- Condition deteriorated, he developed reduced tone on his left side, positive Babinski sign and GCS score of 8/15. He died within 24 hrs of admission.
- Blood Cultures drawn at admission positive for *B. anthracis* after 48/24.
- Blood PCR positive.
- Blood serology anti-protective antigen (PA) IgG positive and anti-lethal factor (LF) IgG equivocal, immunoreactive PA and LF both positive.



Anthrax bacteria in Gram stain

Photo from CDC Public Health Image Library  
. <http://phil.cdc.gov/phil/home.asp>

## Case 3, 41 year old man. NWH Dundee.

- 48-72/24 of confusion, lethargy and feeling generally unwell.
- HCV positive, Heroin user (injection and inhalation), on methadone.
- PMH included pancreatitis, three episodes DVT and an admission to ICU in 2005 as a result of alcohol excess.
- On examination evidence of injecting drug use but no evidence of infection.



T = 38.2°C      HR=72  
BP = 116/72      RR = 36



Case 3: CT HEAD

Extensive subarachnoid blood within supra- and infratentorial cerebrospinal fluid spaces, and small cerebral haemorrhage with adjacent oedema in left frontal lobe.

- GCS deteriorated to GCS 3 with hemodynamic instability. Transferred to ITU for mechanical ventilation and inotrope therapy.
- IV benzylpenicillin 2.4g, clindamycin 1.2g and ciprofloxacin 400mg started based on advice by Microbiology.
- Anthrax immune globulin was arranged to be given, but the patients condition severely deteriorated and he died < 48 hrs after admission.



Interim Clinical Guidance  
for the Management of  
Suspected Anthrax in Drug Users

- Blood Cultures drawn at admission positive for *B. anthracis* after 24/24.
- Blood and ET Aspirate PCR positive.
- Blood serology: negative Anti-PA IgG and negative Anti-LF IgG . Immunoreactive PA and LF both positive.

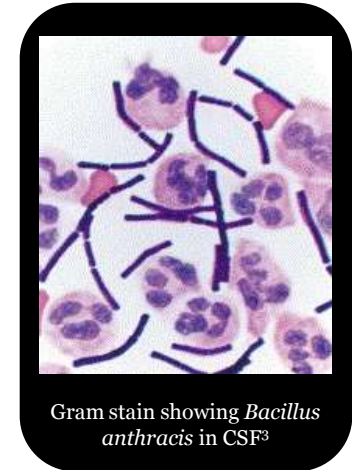
# Summary

- All cases presented with severe illness and neurological symptoms.
- All had a history, and evidence on examination, of IV heroin use. The classical eschar was not present in these cases.
- Only case 3 was pyrexia on admission.
- Admission blood results showed modestly raised inflammatory markers and an obvious thrombocytopenia (mean WCC 11.6 x10<sup>9</sup>/L, mean CRP 30.0 mg/L and mean platelet count 66.7 x10<sup>9</sup>/L).
- All had CT findings of subarachnoid blood, cerebral contusions and (in case 1) cerebral oedema, in-keeping with anthrax meningitis.
- All had microbiology/pathology samples positive for anthrax.
- All had death attributed to haemorrhagic meningitis on post-mortem examination.



# Anthrax Meningitis

- A rare manifestation of the disease, with just over 100 reported cases in the world literature.
- Associated with high mortality and is nearly always fatal.
- First case collection of anthrax meningitis during an injectional anthrax outbreak.



Diagnosis of anthrax meningitis should be considered in patients who inject or inhale heroin particularly if there is evidence of subarachnoid blood on neurological imaging.

# Acknowledgements

- Dr Ben Parcell (Microbiology)
- Dr Linsey Batchelor (Microbiology)
  
- Dr Jonathan Weir-McCall (Radiology, Ninewells)
- Dr Stephen Cole (ITU, Ninewells)
  
- Ninewells Hospital Microbiology Department and Dundee University
  
- Dr Keith Morris and SMA