Equine Infectious Disease – Ancient & Modern

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European Specialist in Equine Internal Medicine
Ancient and Modern???

- Pathogen/host - interaction/battle
- Old foes returning
  - Change in climate and/or vector geographical distribution
  - Old pathogens finding new niches
- New foes emerging
  - New pathogens – novel or newly discovered
Ancient:
- Strangles
- Glanders
- Equine Infectious Anaemia (EIA)
- Equine Influenza (EIV)
- Equine Herpes Viruses 1-4 (EHV1,4)
- African Horse Sickness (AHS)

Modern:
- West Nile Virus
- EHM
- EHV-5
- Hendra Virus
- Equine Encephalosis Virus (EEV)
- Alphaviruses - eg. Eastern equine encephalitis (EEE)
- Hepniviruses -
- Bornavirus
Outline

• International Travel
• Glanders – recent scares in Newmarket and Switzerland – lessons learned
• Equine Infectious Anaemia – state of play in Europe
• West Nile Virus – lineages 1 and 2
• Hendra – lessons learned from Australia
• EEV vs AHS
• Borna Virus – a threat or not?
International Trade

• Horses are the most travelled animal after humans
  • Temporary and permanent movements
  • Inter-continental movements for competition and breeding
• Allows rapid movements of their infections
Outline

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• Equine Infectious Anaemia – state of play in Europe
• West Nile Virus – lineages 1 and 2
• Hendra – lessons learned from Australia
• EEV vs AHS
• Borna Virus – a threat or not?
Glanders – what is it?

- Infectious, zoonotic disease of solipeds.
- Horses, donkeys and mules are the only known natural reservoir.
- Caused by gram-ve bacillus – *Burkholderia mallei*
- *Frequently reclassified* – *Bacillus, Corynebacterium, Mycobacterium, Loefflerella, Pfeifferella, Malleomyces, Actinobacillus and Pseudomonas*
Ancient or modern?

- Hippocrates describes the disease in 425BC
- Aristole describes the disease and calls it ‘malleus’ in 350BC. Causative agent isolated in 1882.
- It was eradicated from many countries BUT is regained status of re-emerging disease because of numerous recent outbreaks.
- Considered a potential bioterrorism agent
Glanders: Global distribution

Globally quite widespread, including:

- Afghanistan, Bahrain, Brazil, Syria, Lebanon, Kuwait, India, Iran, Pakistan, Mongolia, Eritrea, Ethiopia, Sudan, Latvia……..
- But has been eradicated from many previously affected areas
- Concern that political unrest could result in spread of infection
- OIE Reference Laboratory based in Dubai under Professor Uli Wernery
- Scares closer to home in 2011!!
Glanders: 2011

Glanders in horses in Lebanon August 2011 and countries approved for export

Map prepared by IDM
1st August 2011
### Summary of Immediate notifications and Follow-ups - 2011

#### Glanders

<table>
<thead>
<tr>
<th>Country name</th>
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<th>Full report</th>
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**Total**

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Information received on 11/07/2011 from Dr Nabih Ghaouch, Directeur, Direction des resources animales, Ministère d'Agriculture, Beyrouth, Lebanon.

Summary

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<td>Nature of diagnosis</td>
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<td>This event pertains to</td>
<td>the whole country</td>
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New outbreaks

Outbreak 1

| Date of start of the outbreak | 14/04/2011 |
| Outbreak status              | Continuing (or date resolved not provided) |
| Epidemiological unit         | Not applicable |

Affected animals

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<th>Susceptible</th>
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<th>Deaths</th>
<th>Destroyed</th>
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</table>

Summary of outbreaks

Total outbreaks: 1

Outbreak statistics

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<th>Species</th>
<th>Apparent morbidity rate</th>
<th>Apparent mortality rate</th>
<th>Apparent case fatality rate</th>
<th>Proportion animals lost</th>
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<td>Equidae</td>
<td>4.41%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>36.76%</td>
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Glanders: 2011

Department for Environment, Food and Rural Affairs
Veterinary Science Team
Global Animal Health – International Disease Monitoring

Reference: VITT/1200 Glanders, Lebanon 2011
Date: 4 August 2011

Glanders in horses in Lebanon
Preliminary Outbreak Assessment

Note: Defra’s International Disease Monitoring (IDM) team monitors outbreaks of high impact diseases around the world. Glanders is among those diseases of major concern.

1 Disease Report

Lebanon reported an outbreak of Glanders in 25 horses in the Beirut region in July (OIE, 2011; see Map). According to the disease report, the date of the start of the outbreak was 14th May 2011. Three clinical cases were identified and in total 25 horses out of 68 were destroyed. Confirmation was made by Complement Fixation Tests (CFT) and Western Blotting at the OIE Reference Laboratory in Germany.
Clinical Signs In horses

• Three forms – frequently coincide
  • Pulmonary – DDx: EVA, S. equi, fungal pneumonia
  • Cutaneous – farcy - DDx: Epizootic lymphangitis
  • Nasal

• Three time courses
  • Acute – Most frequent in Donkeys and mules
  • Subacute – Mules potentially more resistant
  • Chronic – Horses can be insidiously infected for mths to yrs
Acute Glanders

- High fever, depression, anorexia and emaciation.
- Cough, watery nasal discharge from one or both nostrils.
- Nodules and ulcers in the nasal septum and turbinates.
- These lesions — give mucopurulent/haemorrhagic discharge and dyspnoea.
- SMLN lymphadenopathy.
- Death within a few dys/wk from respiratory failure/septicaemia.
Epidemiology

• Route of transmission – oral/respiratory
  • Can enter through abraded skin, mucus membranes and inspiration of aerosol.

• Disease spreads under overcrowding, poor hygienic and stressful conditions.

• Humid wet environment favourable for bacterial growth
Chronic Glanders

- Long time course with episodic worsening and improving of clinical signs.
- Respiratory form usually present.
- Mild fever, slight dyspnoea.
- As the number of abscesses progress: weight loss, intermittent cough, joint swelling, epistaxis, swelling of the testicles, and haematuria.
- Stress - lung lesions may erupt leading to acute bronchopneumonia.
- Perforation of the nasal septum is frequently seen.

Figure 2. Nodules of lymphatic vessel tracts in the cervical region in a donkey.
Farcy – Cutaneous Form

- Lesions may occur anywhere - inner thigh, limbs and abdomen.
- Lymphangitis (farcy cords)
- Lymphadenitis (nodules/farcy buds/ulcers)
- Chains of nodules with or without ulceration.
- Nodules can break open and give thick purulent discharge – ‘farcy’ oil.
- Deep farcy lesions can cause hock and fetlock jt swelling, occasional diffuse oedema of hindlimbs/shifting lameness.
Disease In Man

- Rare but serious zoonosis
- Usually direct contact with animals affected.
- Enter cutaneously through hands/arms
- Regional lymphadenopathy, fever and lethargy.
- Systemic effects include abscesses in liver, spleen, lungs, pleura and muscles.
- Mortality can approach 95%.
This case occurred in November 2011

- Acute febrile disease
- Inappetance
- Nasal discharge
- Head swelling
- Corded jugular vein

Q1. What are among your differential diagnoses?
Q2. How would you investigate these?
Initial Testing

• Tested *Streptococcus equi* (‘strangles’) negative
  ▪ Negative qPCR and culture of nasal discharge
• Seronegative
• Sudden death occurred on a Saturday morning

Q3. What do you do now?
Q4. What other information might be important?
**Action taken**

- Horse submitted to the AHT for post-mortem examination
- Recent history of importation from the United Arab Emirates (2 weeks ago)

Q5. Does this further information change anything?
What happened

- Review by AHT pathologists and epidemiologist led to reporting of this case as ‘suspect Glanders case’ to Defra/AHVLA under IDHO 1987
- Investigation commenced by AHVLA Bury St Edmunds
  - Investigating VO could not rule out ‘Glanders’

Q6. What particular feature of Glanders needs to be considered in this case?

- Carcase **stored** at AHT but no PME performed
- Transported to AHVLA, Weybridge, Surrey for restricted PME to rule in/out Glanders
Post-Mortem Results

- Restricted PME conducted at AHVLA, Weybridge
- Laboratory tests by AHVLA and HPA Porton Down
  - All **negative** for *Burkholderia mallei*
- Proposed diagnosis: myositis and cellulitis secondary to a pharyngeal foreign body
UK incident November 2011

Incident highlighted the need for:

• Awareness of the global distribution and threats
• Awareness of disease by veterinary profession
• Appropriate facilities for handling suspect cases
• Improved and more rapid diagnostics
• Co-ordinated approach between veterinary and human health authorities
International Distribution

Widespread international distribution


• Concern that political unrest could result in spread of infection

Reports of recent outbreak in one area of Brazil

• No reports of systematic surveillance

Published Date: 2011-07-24 10:12:14

Subject: PRO/AH/EDR> Glanders, equine - Switzerland: (SO) ex Lebanon, RFI

Archive Number: 20110724.2227

GLANDERS, EQUINE - SWITZERLAND: (SOLOTHURN) ex LEBANON, REQUEST FOR INFORMATION

*****************************************************************************

A ProMED-mail post
http://www.promedmail.org
ProMED-mail is a program of the International Society for Infectious Diseases
http://www.isid.org

Date: Sat 23 Jul 2011
Source: aho (Animal Health Online) [in German, machine trans. & summ., edited]

Horse imported from Lebanon positive for glanders

A horse in the equestrian center St. Jacob in Baettwil, in the Swiss canton of Solothurn, tested positive for the bacterium Burkholderia mallei. The animal had been in Lebanon. The farm is under quarantine.

The pathogen is the causative agent of the disease glanders. Humans and other mammals may be similarly infected with this pathogen. [The report includes description of clinical signs, and routes of transmission; for this information, subscribers are referred to the commentary below. - Mod.A5]

Glanders is a zoonotic disease in humans and if untreated it is often fatal. Antibiotic therapy takes an extended period and no vaccines are available. Due to its zoonotic potential and the potential for the disease to spread to horses, the importation of horses is legally regulated. - Mod.A5

24th July 2011

Reported positive Glanders case in Switzerland ex Lebanon!
A ProMED-mail post

http://www.promedmail.org

ProMED-mail is a program of the
International Society for Infectious Diseases
http://www.isid.org

[1]

Date: Fri 29 Jul 2011
From: Heinzpeter Schwermer
[edited]

Re: ProMED-mail Glanders, equine - Switzerland: (SO) ex Lebanon, RFI 20110724.2227

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Please find enclosed a clarification on the respective case. A press release has also been published (available at http://bvet.kaywa.ch/de/tierkrankheiten/vom-sauchen-entwurung.html, German and French only).

Clarification

The Swiss Federal Veterinary Office would like to provide the following clarification regarding the case suspected as glanders, which was today [29 Jul 2011] confirmed negative.

The affected horse was imported from Lebanon into Germany in January 2011 and later -- in May 2011 -- into Switzerland. After an outbreak of glanders in Lebanon, day
Glanders Take Home Message

• Previously eradicated pathogen making a resurgence.

• Clinical signs are diverse and difficult to recognise especially in naive countries.

• Middle east and political unrest could make the disease less traceable.
Outline

• International Travel
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• Equine Infectious Anaemia – state of play in Europe
• West Nile Virus – lineages 1 and 2
• Hendra – lessons learned from Australia
• EEV vs AHS
• Borna Virus – a threat or not?
Distribution of EIA virus 2010

Source: World Animal Health Database
EIA Europe 2010

Source: World Animal Health Database
Distribution of EIA virus 2011

Source: World Animal Health Database
# European EIA outbreaks 2009 -11

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EIA transmission

• Mechanical transmission by insect vectors

• Horse flies (Tabanus), stable flies (Stomoxys), deer flies (Chrysops); limited feeding range (‘lazy, messy feeders’)

• Iatrogenic transmission

• Needles, syringes, veterinary instruments

Aerosol transmission (direct/close contact)? (Rohrer & Mohlmann, 1951)
EIA in Ireland

- Ireland free from EIA until 2006
- Disease confirmed June 15\textsuperscript{th} 2006
- 38 cases over next 6 months
- Movement restrictions and testing
  - 1521 horses on 53 premises
- Racing and surveillance on 8,593 horses in Ireland and 76 horses shipped to other countries
- Czech Republic, France, Germany, Italy and UK
- Overall cost >1m Euro
Initial outbreak cluster: March 2006

• Index cases (4 foals) infected by plasma transfusion, dams also became infected

• 21 cases on 8 farms
  • Between farm spread due to horse movements, not vector activity

• Transmission summary
  • 14 cases by iatrogenic transmission
  • 4 by close contact (dams)
  • 3 by vector transmission
Source of infection

- Equine plasma shipped without licence from Italy to a practice in Ireland
- Plasma used to treat 4 foals

Sporadic EIA outbreaks in Italy
- Associated with importation of slaughter horses from EIA infected countries
- 1 at a plasma production farm in Tuscany
Second outbreak cluster: May 2006

- 3 infected horses from farms in the initial cluster were transported to an equine veterinary hospital in a neighbouring county.
- Triggered second outbreak cluster in horses resident at the hospital and farms to which horses were sent from the hospital.
Second cluster

- 3 index cases, 17 cases in total
- 13 infected whilst resident at the equine hospital
- Hospital transmission by aerosol via close contact?
- Vector borne or iatrogenic infection risk low
Clinical signs

- Fever
- Depression
- Weakness
- Weight loss
- Haemorrhagic diarrhoea
- Haemorrhagic nasal discharge
Serological surveillance

92,000 EIA tests conducted
- 30,000 AGID/Coggins tests
- 62,000 ELISA tests
confirmed cases
- 29/35 Coggins positive
- others confirmed positive by ELISA, Western blot or RT-PCR
- median time to seroconversion 37 days
- some horses took longer than 60 days to seroconvert (c.f. OIE technical manual guidance)
EIA in the UK: 2010

- 16th Jan 2010 - EIA detected in 2/6 horses shipped to UK (Wiltshire) from Romania via Belgium
- 30th April 2010 - Remaining 4 horses test negative
- 7th Sep 2010 - EIA positive horse imported into UK (Northumberland) from the Netherlands
- 11th Sep 2010 - Clinical case of EIA in UK (Devon)
- 16th Dec 2010 - In-contact horses in Northumberland yard test negative
- 23rd Dec 2010 - In-contact horses in Devon test negative
EIA lessons learned
Irish outbreak 2006

• Movement of horses and equine biological products are significant risks to equine health
• Pre-export testing and certification
• Border controls and enforcement
• Post-import surveillance and testing
• Rapid infection spread through horse movement
• Little evidence for vector spread in Ireland
• Likely spread by close contact & vet equipment
• Foals to dams

In the equine hospital from index case with haemorrhagic diarrhoea and nasal discharge
Lessons learned from the UK 2010

- Government agencies (Defra) need to be as well equipped to deal with equine diseases as with farm animal diseases.
- Education for vets needed in new and emerging ‘exotic’ diseases.
- Effective communication to horse owners needed about location of disease outbreaks.

Equine Infectious Anaemia 2010 Lessons Learned www.defra.org.uk
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• EEV vs AHS

• Borna Virus – a threat or not?
West Nile Virus (WNV)
West Nile Virus – UK Testing

- Previously considered by Defra as a significant notifiable disease
- Request by veterinary surgeons for testing for WNV assumed disease suspected
- Would trigger immediate premises restrictions
- Effect was counter-productive as reduced surveillance/early detection potential
- Based on mis-conception re. zoonotic risk?
- Now can test for WNV serologically in suspected cases or to rule out from a DDx list without triggering a premises restrictions
Epidemiology and Vectors

• Life cycle complex

• Need to understand the epidemiology of the disease & ecology of the pathogen to optimise control & prevention.

• **Horse** is a dead end/incidental host

• Not a threat to human health but an important sentinel

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**West Nile Virus Transmission Cycle**

- **Mosquito Vector**
- **Incidental Hosts**
- **Amplifying Host**

Via bridge vectors
Texas Counties With West Nile Virus in Horses, 2002

Legend
- Not Sampled
- Positive
- Negative

Updated: Tuesday, July 27, 2004

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WNV has a changing global distribution

Approximate Global Distribution of West Nile Virus, by State/Province, 2007

Lineage 1 since 1999
Lineage 2 Emergence in Europe

- Lineage 2 previously confined to Africa emerged in 2004 and established itself in Hungary.
- 2007 first equine case seen in horse in Eastern Hungary.
- Birds of prey such as goshawk and sparrow-hawk deaths seen.
Lineage 2 establishes itself in central Europe

- 2008 15 wild birds, 4 horses (1 lethal) and 4 human WNV diagnosed in Hungary

- Austria 6 goshawks, one kea and one snowy owl.

- The virus was not expected to survive the first winter and has proved new establishment of successful infection cycle in Europe of this previous African lineage.
Possible Introduction to the U.K.

- **Birds** or **Mosquitoes** may introduce infection
- Increased risk to humans and horses recently?

West Nile virus vector *Culex modestus* established in southern England

Nick Golding¹, ²*, Miles A Nunn², Jolyon M Medlock³, Bethan V Purse⁴, Alexander GC Vaux³ and Stefanie M Schäfer²
humans. It does seem likely, however, that the risk posed to horses, which are often grazed in the North Kent Marshes, will have increased. In light of this, and until the national distribution of *Cx. modestus* is established, surveillance for WNV in the United Kingdom should now focus on this part of Kent.

In summary, the discovery of populations of *Cx. modestus* in southern England suggests a recent introduction of this species and provides further evidence for expansion of its geographic range. There is an associated increased risk posed to the United Kingdom by WNV and other pathogens transmitted by *Cx. modestus*. 
Take Home Message for WNV

• WNV lineage 1 in southern Europe and lineage 2 in central Europe

• Can now test for WNV in UK without triggering premises restriction unless proves positive.

• Horses are good indicators for emergence of the disease in a new territory.
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Hendra Virus

• Emerging disease since 1994

• ‘Spillover’ disease of horses from fruit bats, with infected horses infecting humans

• The ‘ultimate’ equine zoonotic disease?

• Has considerably raised awareness about PPE in affected areas
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**Incident 5:**

**Cawarral, August 2009.** A Queensland veterinarian died in September after being exposed to Hendra. Infection has been confirmed in two horses that died and another had to be destroyed after returning a positive test. The incident was discovered after a property manager and a local veterinarian alerted Biosecurity Queensland with the death of a horse suffering from respiratory distress.
EEV and AHS

- Milder and often asymptomatic in endemic areas.
- Important DDx for AHS – Israel 2009 – Fever, oedema of neck, legs, lips and eyelids, congested mucus membranes, tachycardia and tachypnoea.
- Morbidity 2-100% but no fatalities c.f. with AHS
Ghana: 129/159 (81%)

The Gambia: 144/144 (100%)

EEV-3 (Kaaplaas)

Ethiopia: 206/220 (94%)

Morocco: 0/100 (0%)

Israel: EEV Outbreak in 2009 EEV-3 (Kaaplaas)

South Africa: EEV endemic country

The Gambia: 144/144 (100%)

EEV-3 (Kaaplaas)
Borna Virus

• Sporadic neurological disease in Germany, Austria, Switzerland and Lichtenstein.

• Non-suppurative meningoencephalitis

• ?Zoonosis


Borna disease virus infection of a horse in Great Britain.

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Take Home Messages

• Exotic Diseases either new or re-emerging pathogens are more of a threat today than in recent history.

• Knowledge of these diseases will aid detection of a new incursion.

• Real and recent examples are available and lessons learned must be acted on.

• National boundaries are not the protection they once were.
Questions?
Acknowledgement

Glanders:
• Richard Newton, Animal Health Trust, Newmarket
• Cornelia Herholz, Swiss College of Agriculture

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• Josh Slater, The Royal Veterinary College, London

WNV:
• Richard Newton, Animal Health Trust, Newmarket
• Norbert Nowotny, Vienna Veterinary School