Viral Haemorrhagic Fevers

Major Dan Burns
Infectious Diseases Registrar

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Outline

• Viral Haemorrhagic Fevers
• West Africa Ebola Outbreak

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Viral Haemorrhagic Fevers

“a range of severe and life-threatening conditions caused by a variety of different viruses”
Quiz & Examples

Viruses that may cause systemic haemorrhage & fever
Yellow fever
Dengue fever

Families
Arenaviridae
Bunyaviridae
Filoviridae
Flaviviridae

& high CFR & person-person transmission
Ebola
Marburg
Crimean-congo haemorrhagic fever
Lassa fever
Lujo
Junin
Machupo
Guanarito
Omsk haemorrhagic fever
Kyasanur Forest disease
Figure 1. Epidemiology of viral haemorrhagic fever – a complex picture.

Crimean–Congo fever (Bunyaviridae family)
Widespread area of endemicity, extending across much of Africa, the Middle East and into Asia. Reservoir and the vector: ixodid (hard) ticks. Ruminants and domesticated animals can serve as amplifying hosts. Person to person transmission has been reported through bodily fluids, including through medical equipment.

Ebola (Filoviridae family)
Countries reporting current outbreaks include Guinea, Sierra Leone, Liberia and Nigeria. Historical outbreaks reported in several central African countries and South Africa. Natural reservoir: not yet confirmed, but may be bats. Consumption of bush meat is a risk factor. Person to person transmission is through bodily fluids, including through health-care equipment.

Lassa ( Arenaviridae family)
Countries reporting endemic disease include Guinea, Sierra Leone, Liberia and Nigeria, with periodic isolation reported in other West African countries. Reservoir: Mastomys (a rodent). Transmission is via contact with its urine and droppings or objects/food contaminated with them. Person to person transmission can occur through bodily fluids.

Other identified viral haemorrhagic fevers include:
- Luju – South Africa
- Chapare and Machupo – Bolivia
- Kyasanur forest disease – India
- Alkhurma – Saudi Arabia
- Guanarito – Venezuela
- Junín – Argentina
- Sabiá – Brazil
- Omsk – Russia

Dengue (a flaviviridae) is a mosquito-borne virus prevalent across much of the tropics which causes a febrile illness. A small minority (more frequent during a second infection) progress to haemorrhagic shock through a process of antibody-dependent enhancement. Person to person transmission is rare and has only been reported through blood transfusion and transplantation.

Marburg (Filoviridae family)
Countries reporting previous outbreaks include Angola, Democratic Republic of Congo, Uganda, Zimbabwe and South Africa. In the 1960s cases were also reported in Germany and Belgrade. Natural reservoir: animal, most likely bats. Person to person transmission can occur through contact with bodily fluids.
Researchers identify new deadly virus in Africa

A deadly newly identified virus that causes bleeding like Ebola has killed four of the five people it has infected, researchers say.

The Lujo virus infected five people in Zambia and South Africa last September and October, Dr. Ian Lipkin, an epidemiologist at Columbia University in New York and his colleagues reported Friday in the online journal PLoS Pathogens.

"The course of disease in cases 1 through 4 was fatal; case 5 received ribavirin [antiviral] treatment and recovered," the study's authors wrote.

In comparison, between 50 per cent and 90 per cent of people infected with Ebola virus succumb to death by internal bleeding.

The virus was given the name Lujo after Lusaka, Zambia, and Johannesburg, South Africa,
Viral Haemorrhagic Fevers

- Yellow Fever
- Dengue HF
- Rift Valley Fever
- Crimean-Congo Haemorrhagic fever
- Kyasanur Forest Disease
- Omsk Haemorrhagic Fever
Viral Haemorrhagic Fevers

- Lassa Fever
- Junin, Machupo, Guanarito, Sabia
- Hantavirus

- Ebola
- Marburg
Clinical Presentation

- Incubation times 3 – 16 days
- Fever, headache, muscle-ache and non-specific symptoms
- Generally later develop haemorrhage (& not in all) often with organ failure
- Recovery (or not)
- May be specific features
  - Ebola GI disease v common
  - Dengue has a characteristic rash
  - Lassa; sore throat & facial oedema common
  - CCHF has a > risk of bleeding than others
Infection Control

Blood borne viruses

Source isolation
Dengue

- Globally widespread
  - SE Asia, Caribbean, Pacific
- *Aedes* species mosquito
- Most cases do **not** cause haemorrhage
- Risk factors for dengue haemorrhagic fever
  - Extremes of age
  - Prior morbidity
  - Subsequent serotype infection
- Severe dengue
  - Oedema & third spacing
  - Low platelets & bleeding (petechiae, mucosal & GI bleeding)
- No person-person transmission
Dengue fever – Typhoon Haiyan (Super Typhoon Yolanda)

- Figure 1. Weekly number of dengue cases reported to PIDSR in Region 8, the Philippines, 2013–2014 ($n = 5264$)

* Epidemic threshold is the average annual number of cases reported in the previous five years.
Yellow Fever

- South America and Africa
  - Sylvatic & urban transmission
- Mosquito-borne:  
  - *Aedes* spp
- Fever, nausea, pain
- 1 in 20 develop toxic phase with liver failure
- 50% mortality if jaundice
- 200,000 case per year, 30,000 deaths
- No person-to-person transmission
Yellow fever outbreak Angola, Democratic Republic of the Congo and Uganda 2016-2017

Winning the war against yellow fever
25 November 2016 — Four months have passed without a single case of yellow fever related to the outbreak in Angola and the Democratic Republic of the Congo, thanks to the joint response activities of national health authorities, local health workers, WHO and partners. Read the story

Situation report
962 cases
The outbreak caused 962 confirmed cases of yellow fever across the two countries

Vaccinated
30 million
30 million people have been vaccinated in Democratic Republic of the Congo and Angola.

International spread
3 countries
Three countries have reported yellow fever cases exported from Angola.

Timeline: Yellow fever outbreak 2016

Brazil

Brazil faces new yellow fever outbreak—and questions over lack of preparedness

The country plans to vaccinate its entire population against the lethal mosquito-borne disease but specialists doubt its capacity to do so

Dom Phillips in Rio de Janeiro
@domphillips
Wed 28 Mar 2018
08:00 BST

This article is over 2 months old
Congo - Crimea HF

- Africa, Asia, Middle East, Eastern Europe
- Tick borne, or from animal slaughter
- Person-person and nosocomial transmission
- Mortality up to 30%
- Treatment - ribavirin
The number of CCHF cases in Kosova, 1954-2015

- First serological cases of CCHF in Kosova are recorded in 1989.
- Cases between 1954-1989 are not proved.
- 1989-2015 – sporadic cases and every 4-5 year epidemic outbreaks are recorded.
- A total number of confirmed cases: 295 serologically / virologically confirmed cases and 2324 suspected CCHF cases.
- Mean mortality rate 23.3%
Health care response to CCHF in US soldier and nosocomial transmission to health care providers, Germany, 2009


Research output: Contribution to journal › Article

Abstract

In 2009, a lethal case of Crimean–Congo hemorrhagic fever (CCHF), acquired by a US soldier in Afghanistan, was treated at a medical center in Germany and resulted in nosocomial transmission to 2 health care providers (HCPs). After his arrival at the medical center (day 3, illness), the patient required multiple hospitalizations to control symptomatic and systemic complications; these HCPs were placed in isolation for 21 days, during which time no transmission occurred. The entire hospital ward was declared clean after 21 days, but a second case of nosocomial transmission occurred in another patient who worked in the ward where the first case was treated. The outbreak was contained successfully. This experience provides valuable lessons for the effective management of a nosocomial CCHF outbreak.
Crimean-Congo Viral Haemorrhagic Fever case in Glasgow

A man is being treated in complete isolation in Glasgow after being confirmed as having Crimean-Congo Viral Haemorrhagic Fever.

The 38-year-old man is said to be in a critical condition in the city's specialist Brownlee unit.

He was admitted to hospital less than three hours after returning to Glasgow on Emirates flight EK027 from Dubai.
Lassa Fever

- West Africa only
- *Mastomys natalensis* reservoir
- Spread through contact with body fluids
- 5000 deaths; 150000 clinical cases
- Insidious onset
  - fever 7 -17 days
  - myalgia ++
  - no meningoencephalitis
  - pharyngitis, white tonsillar patches
  - facial oedema
- Ribavirin effective
- Person-person and nosocomial transmission
Lassa Fever – Nigeria

Disease outbreak news
1 March 2018

From 1 January through 25 February 2018, 1081 suspected cases and 90 deaths have been reported from 18 states (Anambra, Bauchi, Benue, Delta, Ebonyi, Edo, Ekiti, Federal Capital Territory, Gombe, Imo, Kogi, Lagos, Nasarawa, Ondo, Osun, Plateau, Rivers, and Taraba). During this period, 317 cases have been classified as confirmed and eight as probable, including 72 deaths (case fatality rate for confirmed and probable cases = 22%). A total of 2845 contacts have been identified in 18 states.

Fourteen health care workers have been affected in six states (Benue, Ebonyi, Edo, Kogi, Nasarawa, and Ondo), with four deaths (case fatality rate = 29%). As of 18 February, four out of the 14 health care workers were confirmed positive for Lassa fever.
Marburg

- First description – 1967
- New viral class - filoviridae
- Outbreaks in forested East Africa (mostly)
  - Uganda
  - Kenya
  - DRC
  - Angola
- High case fatality
- High risk of person-person and nosocomial transmission
99 in Uganda quarantined after Marburg virus death

From Samson Ntale, for CNN

Updated 1329 GMT (2129 HKT) October 8, 2014
Ebola

- Sub-saharan Africa & West Africa
- Bat reservoir
- Person-person and nosocomial spread
- High case fatality rate – 55% upwards
- Effective vaccine
- Experimental treatments with unclear efficacy
Epidemiology

Outbreaks of EVD before 2014

- Sudan:
  - 1976: 284 cases
  - 1979: 34 cases
  - 2004: 17 cases
- Uganda:
  - 2000: 425 cases
- DRC (ex-Zaire):
  - 1976: 318 cases
  - 1977: 1 case
  - 1995: 316 cases
- Côte d'Ivoire:
  - 1994: 1 case
- Gabon:
  - 1994: 52 cases
  - 1996: 37, 61 cases
  - 2001-02: 65 cases
- Congo:
  - 2001-02: 57 cases
  - 2002: 13 cases
  - 2003: 143, 35 cases
  - 2005: 12 cases
- South Africa:
  - 1996: 1 case following 1 imported case from Gabon
Weekly reported Ebola cases

GUINEA

LIBERIA

SIERRA LEONE

Source: WHO
The 2014-5 epidemic

Sierra Leone 14122 cases 3955 deaths
Liberia 10666 cases 4806 deaths
Guinea 3804 cases 2536 deaths
HCWs 815 cases 507 deaths
Ebola Outbreak in West Africa: Timeline of Events

**December 2013:** Initial cases of Ebola emerge in Méliaoudou, Guinea. Index case is suspected to be a two-year-old boy who subsequently died on December 6.

**January 26:** Facility in Méliaoudou reports 5 unusual deaths to Ministry of Health in Conakry.

**February:** Nurse in Guéckédou infected by one of the original Méliaoudou patients.

**March 21:** Guinea Ministry of Health notifies WHO, WHO declares public alert.

**March 20:** Lab tests confirm Ebola.

**March 14:** Guinea Ministry of Health reports outbreak of unknown cause to WHO.

**March 14:** Liberia reports confirmed EVF case to WHO.

**April 1:** MSF warns outbreak is "unprecedented." 

**April 1:** WHO approves use of untested vaccines and/or treatments.

**April 21:** Samples from Sierra Leone and Mali so far all negative.

**May 26:** WHO announces confirmed case from Kailahun, Sierra Leone.

**May 27:** New cases reappear in Conakry.

**June 7:** Liberia announces first case since April 6.

**June 30:** Liberia shuts schools and uses military to quarantine communities.

**July 30:** Nigeria reports first cases in Lagos.

**July 26:** CDC sends expert to Sierra Leone to assist MoH and WHO.

**July 21:** Peace Corps evacuates Liberia, Sierra Leone and Guinea.

**August 8:** WHO declares PHEIC.

**August 25:** Two American missionaries infected in Liberia are flown to US.

**August 28:** WHO announces strategic plan to fight Ebola; says $490 million will be needed for implementation.

**August 29:** Senegal reports first case.

**August 30:** The World Food Program requests $70 million for affected areas.

**September 2:** MSF President Liu lament's "global coalition of inaction."

**September 5:** EU commits $180 million

**September 6:** HHS contracts with manufacturer of ZMapp; NIH starts testing vaccines. DoD funds two companies to develop therapeutics.

**September 7:** President Obama says US should be doing more to assist.

**September 8:** UK sets up a treatment center in Sierra Leone; US says it will send field hospital to Liberia.

**September 10:** Bill & Melinda Gates Foundation commits $50 million

**September 16:** US says it will send 3000 military personnel to West Africa; Congress approves $88 million

**September 18:** Number of reported cases over 5300 with over 2600 deaths.

*Figure adapted from WHO situation report, Sept 18, 2014—https://apps.who.int/iris/bitstream/10665/133883/1/roadmapsitrep4_eng.pdf?ua=1*
UK Military Roles

• Establish 7 ETCs & support a total of 882 beds in Sierra Leone

• Command & control support including IT, Sat phones & co-ordination

• Engineering & logistics (with DFID & local contractors)

• EVDTU for HCWs at Kerry Town run by DMS staff
  (Others run by various international NGOs)

• Most of the laboratory work at Kerry Town
  (EBOV PCR testing run by PHE)

• Ebola Training Academy in Freetown (for local HCWs)

• Force health protection, primary & secondary care (own staff)

• Casualty transportation (both locally & internationally)

Which do you think was most important?
Lessons learned during epidemic

- Training
- Natural history of disease
- Ebola case management
- PPE
- Patient transport
- Global epidemic warning systems & response

House of Commons
International Development Committee

Ebola: Responses to a public health emergency
Training
Clinical Course

Clinical picture of patient vomiting & diarrhoea
Safe system of work

- Trained in your PPE
- Buddy system
- Doffing procedure
- Keep environmental clean
- Waste disposal
  - Vernagel
  - Catheters
  - Flexi-seal
- Limit time in “red zone”
- Timing risky procedures
Ebola Virus Disease – Case management
Patient Transport – RAF, LAS & others

• 24 Aug 2014 - Sierra Leone (confirmed EVD)

• 29 Dec 2014 - Glasgow (confirmed EVD)

• 31 Jan 2015 - Sierra Leone (credible EVD exposure)

• 2 Feb 2015 - Sierra Leone (credible EVD exposure)

• 16 Feb 2015 - Sierra Leone (low possibility EVD exposure)

• 25 Feb 2015 - Sierra Leone (low possibility EVD exposure)

• 12 Mar 2015 - Sierra Leone (confirmed EVD)

• 12 Mar 2015 - Sierra Leone (low possibility EVD exposure) x 2 (and two others same episode by separate civilian Air Ambulance)

• 23 Feb 2016 - Glasgow (confirmed EVD)*

• 7 Oct 2016 - Glasgow (confirmed EVD)
Medical evacuations and repatriations due to Ebola infection or exposure to Ebola virus, as of 24 June 2015.

Number of evacuations by country:
- 1
- 10
- 100

Place of evacuations:
- Liberia
- Mali
- Sierra Leone

Evacuated to:
- United States
- Spain
- Germany

EVD affected countries:
- Liberia

Previously EVD affected countries:
- Sierra Leone

ECDC. Map produced on 24 Jun 2015.
Equipment or Capability?
into its side. In 2005 Phoenix Air, an air ambulance service out of Cartersville, Georgia, bought all three, and a few years later worked with the Centers for Disease Control and Prevention on another modification—one that would be Brantly’s home for the duration of the 14 hour flight. It’s called the Aeromedical Biological Containment System, a sort of framed tent made of thick, clear plastic with a negative-pressure, HEPA-filtered air supply designed to keep the cabin clear of infections. It was built to transport patients during the SARS outbreak of 2003 but never used. This would be its first real test.

Once Flueckiger agreed his team could do it, they started rehearsing. He estimated they could learn the moves and prep the flight in as soon as 48 hours after the decision. Samaritan’s Purse, one of the aid groups Brantly and Whitebol worked for, agreed to pick up the bill. (Phoenix Air declines to say how much Brantly’s flight cost, but so far $2 million has been spent on transport and treatment for him and Whitebol). “It was rather hastily put together, but we knew people were waiting to hear when we were ready,” Flueckiger says. He knew that no one ever calls them unless things are bad. “We’ve always said that we hope we never have to use the unit.”
Ebola: Hospital mistakes blamed for US transmission

A US health chief has said a mistake was "clearly" made by hospital staff treating an Ebola victim in Texas, resulting in one member being infected.

Features

Computer commentary
Would you train a machine to describe a sports match?

Catalogue of errors in Madrid Ebola case
Health service under scrutiny due to Ebola scare in Madrid
Thank you
Questions?