Ebola Virus Disease
Epidemiology and Clinical Update

Edward I. Galaid, MD, MPH
Medical Director, RSF Workforce Health Solutions
Roper St. Francis
Charleston, South Carolina
Objectives

• Set the stage for discussing LEO safety when dealing with possible Ebola cases.

• Review Agent/Host/Environment causal factors and Ebola infection in Africa and U.S.

• Review clinical features of Ebola infection, and the treatment of Ebola with 21\textsuperscript{st} century medical care
Dr. Galaid has nothing to disclose.
Agent: Ebola Virus

- Immune evasion strategies of virus
- Vaccine strategy focuses on finding an effective adjuvant plus choice of antigen
Infection of Monocyte ➔ Cytokine Storm ➔

TNFα, IL-6, IL-8, etc.

Cell death/Cytokine storm
Endothelial Cell Toxicity $\rightarrow$ Vascular Instability and Shock, Cell Death
Host Factors
Host Factors

• Host and Reservoir: Fruit Bats
  – Consumed as delicacy in Africa

• Dead-End Hosts: Humans and NHP’s
  – NHPs also consumed as “bush meat”
Hypsognathus monstrosus
Ebola Virus Disease is a Zoonosis.

Ebolaviruses:
- Ebola virus (formerly Zaire virus)
- Sudan virus
- Taï Forest virus
- Bundibugyo virus
- Reston virus (non-human)

Following initial human infection through contact with an infected bat or other wild animal, human-to-human transmission often occurs.

Human-to-human transmission is a predominant feature of epidemics.
Human to Human Transmission

• Difficult to study

• Spread by Contact; ?Breach during doffing PPE in Dallas HCW cases

• Most mode of transmission and portal of entry studies done on NHPs and rodent models.

• ? Aerosol and droplet spread in experimental animal studies
Ebola in the Domestic Environment

- Concerns until now focused on healthcare environment...see narrative of Dallas MD
How can the LEO function?
Number of Viral Particles Necessary to Transmit Disease = 10-12

- Orders of magnitude more infectious than
  - Hepatitis B
  - Hepatitis C
  - HIV
Culture(+) or PCR(+) in Body Fluids Acute Phase of Illness (Bausch et al, 2007)

- Saliva 8/12
- Skin 1/8
- Urine 0/7
- Vomit 0/1
- Stool 2/4
- Sputum 0/1
- Semen 14/23
- Sweat 0/1
Ebola in the Domestic Environment

- Role of inanimate objects/fomites
- Role of domestic animals
Longevity of Virus in Environment

“...There are many factors that influence persistence, including surface type, temperature, humidity, light, initial level of virus, and presence/absence of biological buffer (ie. in blood, urine, etc).
Longevity of Virus in Environment

...the virus can persist for hours to days depending upon the ambient conditions. I also note that the virus is easily inactivated and that long-term environmental contamination is NOT a real concern.”

“Keep the focus on human-to-human transmission...”

Daniel G. Bausch, MD, MPH&TM
Head, Virology and Emerging Infections Department
U.S. Naval Medical Research Unit No.6
Lima, Peru
Ebola Virus Ab Prevalence in Dogs and Human Risk

• 2001-2002 Gabon outbreak

• Investigators saw dogs eating dead animals

• 439 dogs sampled using IgG assay, Ag detection and PCR
Ebola Virus Ab Prevalence in Dogs and Human Risk

- Seroprevalence in dogs in regions with both infected animal carcasses and human cases = 31.8% compared with 2% among 102 samples from France.
Ebola Virus Ab Prevalence in Dogs and Human Risk

• Au: “Given the frequency of contact between humans and domestic dogs, canine Ebola infection must be considered as a potential risk factor for human infection and virus spread.”

Allela et al  EID 2005
Clinical and Lab Features of Hemorrhagic Fevers

Citation:
Kortepeter MG, Bausch DG, Bray M.
JID 2011;204: S810-S816
Ebola Virus Disease

- Fever, rash, thrombocytopenia as standard features of illness

- Incubation Period: 6-7 days in 2 needlestick cases; 3-13 days in outbreaks

- No evidence of viremia during incubation period
Conjunctival Hemorrhage of Ebola
Rash of Ebola

A hemorrhagic rash appears over entire body
Ebola Virus Disease

• Serum levels of viral genomes rise during first week of illness; highest levels in fatal cases

• In survivors, viremia usually becomes undetectable by end of second week of illness

• Infectious virus may persist in aqueous humor and testes (one case of ST Marburg reported)
Ebola Virus Disease

- Abrupt onset nonspecific S&S:
  - F, C, N, V, D, H/A, Fatigue, Myalgias

- Unless clinical suspicion is high, typical assumption is that it’s typhoid or malaria

- Not suspected until rash, hemorrhage, or person-to-person spread, typically in HCWs
Fever in Ebola Virus Disease

- Temps frequently >101
- Wide swings in body temperature
- Pulse temperature dissociation (also seen in typhoid, dengue, mycoplasma, others)
Rash in Ebola Virus Disease

- Onset early in course of illness
- Nonpruritic
- Erythematous
- Macupapular
- Focal, then generalizing and confluent
- Some reports of measles-like or scarletinoid
Hemorrhage in Ebola Virus Disease

- Thrombocytopenia develops early in illness
- DIC
- Conjunctival hemorrhages
- Injection or venipuncture sites
- Not seen in all patients
- Massive bleeds typically GI
Clinical Course

• In fatal cases, majority of deaths occurred during second week of illness

• Those who were still alive on Day 14 had a >75% chance of survival

• Recovery is prolonged...weeks to months