Ebola: Past, Present, & Future

Janet A. Jokela, MD, MPH, FACP, FIDSA
Head, Department of Medicine, University of Illinois at Urbana-Champaign
Governor, ACP Downstate Region Illinois Chapter
April 2015: Alaska ACP & AKOMA Meeting

No financial or other conflicts of interest

Objectives

- List features of the Ebola virus & Ebola virus disease
- Describe the current Ebola outbreak in West Africa
- Describe infection control measures and preparedness efforts
Patient

- 45 year old man presented with abdominal pain, dizziness, nausea, headache
- T 100.1°F
- Nasal congestion, abdominal tenderness
- CT head, abdomen/pelvis: no acute disease
- WBC 3.08, platelets 92, glucose 180, creatinine 1.41, AST 94 (normal < 34)
- 103.2°F → T 101.2°F
- Discharged: sinusitis & abdominal pain; acetaminophen

Three days later...

- Returned with diarrhea, abdominal pain, fever
- Admitted to the hospital
- 12 hours later: explosive diarrhea, projectile vomiting
- Day #2: too weak to use bedside commode, transferred to ICU
- Day #3: diagnosed with Ebola
- Day #11: dies from Ebola

Photo of Thomas Eric Duncan
thescoopblog.dallasnews.com
Calendar of Ebola Patient Duncan course.


Past...

- List features of the Ebola virus & Ebola virus disease
- Describe the current Ebola outbreak in West Africa
- Describe infection control measures and preparedness efforts

Ebola Virus

- Ebola Virus Disease (EVD)
- Causes severe illness with 50%-90% mortality
- First discovered in 1976
  - Democratic Republic of Congo
- Sporadic outbreaks
  - 36% involved <10 people
  - Only 1 has involved more than 450 people
**Ebola Virus**

- ssRNA
- Filoviridae, genus *Ebolavirus*
- Five species:
  - Zaire, Sudan, Tai Forest, Bundibugyo; Reston
- Reservoirs in Nature
  - Fruit bats, other?
- Disease: Humans, nonhuman primates (gorillas, chimpanzees, monkeys)

**Transmission**

- Direct contact body fluids
  - Blood, urine, diarrhea, vomit, semen
  - Deceased
- Medical environment/waste
  - e.g., syringes
  - “Bushmeat”
- 21-day incubation
**Signs/Symptoms**

- Appear 2-21 days after exposure
- Fever higher than 101.5°F
- Severe headache
- Muscle pain
- Weakness
- Diarrhea
- Vomiting
- Abdominal pain
- Unexplained bleeding or bruising

---

**Clinical Timeline**

CLINICAL FEATURES OF EBOLA VIRUS DISEASE
Chart from New England Journal of Medicine


Calendar of Ebola Patient Duncan course.
Clinical findings

- Fluid losses: 5-10 L/day
- Hypovolemia
  - Despite weight gains 15-20 kg
- Electrolyte imbalance
  - arrhythmias
- Malnutrition
- Virus detected: blood, urine, vomitus, stool, semen, on skin
  - Environmental testing (Emory): no virus
Graph from:
Lyon GM, et al. NEJM, 12/18/2014

Unexpected findings: Emory

- Point of care lab vs. hospital lab
- Shipping commercial carriers
- Local water authority
  - Bleach
  - Autoclaving waste
- Media
- Pizza

Environment

- Six hours (saliva, blood, fecal material, urine, semen)
- Stable longer: if dark or cold, moist
- Bodies: up to a week
- Disinfected by 0.05% bleach
Clinical course

- Age (Sierra Leone)
  - Under 21 years—57% fatality rate
  - Over 45—94% fatality rate
- Antibodies
  - Monoclonal: Zmapp
  - From survivors


Diagnosis & Treatment

- Testing performed via CDC/Public Health
- No vaccine or medication proven effective
- Only treatment is supportive care

Present...

- List features of the Ebola virus & Ebola virus disease
- Describe the current Ebola outbreak in West Africa
- Describe infection control measures and preparedness efforts
Ebola Outbreak 2014-2015

- Persistent transmission only in Sierra Leone & Guinea
  - Liberia: last Ebola patient sent home 3/6/2015

- As of March 11, 2015
  - 24,385 total cases
  - 10,019 deaths

- In the US
  - 2 cases acquired here—recovered
  - 8 imported cases—two deaths

Graph – how many people have been infected in Africa?
NYTimes, Feb. 17, 2015
Graph of new patients each week:
Liberia, Sierra Leone, Guinea
NYTimes, 3/11/2015

Map of Cases of Ebola Outside of West Africa
NYTimes, November 5, 2014

Patients diagnosed in U.S.

- Sept. 30—first patient diagnosed Dallas (dies Oct. 8)
- Oct. 10—nurse diagnosed (d/c 10/24)
- Oct. 15—second nurse diagnosed (d/c 10/28)
- Oct. 23—medical worker diagnosed NYC
The Opinion Pages: Room for Debate
NYTimes, October 2, 2014

Multi-pronged effort

NYTimes photo of young
Girl on ground with crowd
And police watching from
Across the street
Craig Spencer, MD

“Failing to stop the epidemic at its source threatens everyone”

Craig Spencer, MD, NEJM, 2/25/2015

Present...

- List features of the Ebola virus & Ebola virus disease
- Describe the current Ebola outbreak in West Africa
- Describe infection control measures and preparedness efforts

Triage

- Travel history
- Private room
Prevention Measures

- **Staff**
  - *Regular practice*
  - Limit number of staff entering the patient room
    - Dedicated clinical care team (inpatient)
  - Post an Entry Log outside of patient room
  - Properly don, doff, and dispose of PPE
  - Perform hand hygiene diligently

- **Visitors**
  - No visitors in the patient room

[Link to CDC video on Ebolad Donning and Doffing of Personal Protective Equipment (PPE)]

[Link to CDC video on Ebolad Donning and Doffing of Personal Protective Equipment (PPE)]
Bioccontainment Units

- Emory
- Omaha, NE
- NIH
- Missoula, MT

Special units

- Patient care rooms
  - Anteroom
  - Autoclave
  - Point-of-care lab
- Nebraska: 5 rooms, 2 beds each
Staff

- 21 RN team
  - Routine, ongoing training; volunteers
- Respiratory therapists, patient care technicians
- Day shift: 6 staff members (at least 3 RN's)
  - Autoclaver
  - "Doffer"
  - Bedside nurse always with patient
- Four hours at a time

In the patient room

- Anytime staff member has contact with patient, or fluids:
  - outer gloves removed, middle layer bleach wiped, replace outer gloves
- Every night:
  - Staff clean room (not housekeeping)
  - Every surface bleach wiped
  - Separate mop buckets each area (nurse's station, patient room, hallway)
  - Mop heads changed

Personal Protective Equipment

- Surgical boot covers (knee high)
- Impermeable gown
- Hood
- Gloves: three pairs
- N-95 mask
- Face shield
- Apron (for specific procedures, then removed immediately)
Future...

- What are the other current issues and concerns?

Questions

- Does the infectious dose of virus depend upon how it enters the body?
- Does the length of the incubation period depend upon how the person was infected?
- Optimal decontaminants?
- Economic and social impact?
- Etc...

IOM Research Priorities

- PPE training
- Supply chain optimization
- Standards for PPE apparel/equipment
- Developing a framework for evaluating the system in which PPE is embedded
- Compliance with PPE use
- Healthcare worker fatigue
- Socializing in the workplace & with family
Vaccine

- Multiple efforts
- Entering final stages of trial in Guinea (03/2015)
- Fewer patients: more challenging

Recovered

- Photo from nydailynews.com
- Showing US President Hugging Dallas nurse after She was released for Ebola Treatment
- October 24, 2014

or is she?...

Washington Post photo Of Nina Pham, Ebola survivor

Nina Pham survived Ebola, but she says she has experienced hair loss, body aches and insomnia in the months following her infection. (Smiley N. Pool/Dallas Morning News via AP) March 9, 2015
Post-Ebola Syndrome

- Develops within weeks, duration months
  - Visual problems
    - May progress to blindness
  - Fatigue
  - Myalgias, arthralgias
- Pathogenesis unknown
- No known treatment

Airport Screening

- ~125 passengers/day from Guinea, Liberia, Sierra Leon
- Since August 2014 exit screening:
  - 80,000+ passengers: 77+ denied boarding, none with Ebola
- Entry screening October 2014:
  - JFK, Newark, Dulles, Atlanta, O’Hare
  - Three levels; monitored by local health depts.
- Two left without symptoms, diagnosed in U.S.
  - Dallas patient, NYC patient

New PPE

New PPE


Getting to Zero-Zero

- Zero cases, Zero transmissions
- Pockets persist
- Complacency
- Unsafe burial practices

Future

- Screening
- Vaccine
- Hospital/Medical preparedness
  - Training
- West Africa
  - Cities
  - Culture
Thank you