Ebola

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Sudan - June 27, 1976

- Nazra Township Cotton factory storekeeper became ill
  - 48 cases/ 27 deaths
  - Contact was admitted to local hospital in Maridi
- Unrelated cases continued in cotton factory workers July-Oct.

Content Provider: CDC/ Dr. Lyle Conrad; 1976

Sudan 1976

- Barrier nursing/disposable isolation equipment established early October
- WHO team arrived on October 20, 1976
  - Isolation precautions
- Last case occurred on November 20, 1976
  
  284 cases, 151 deaths (mortality rate 53%)

Content Provider: CDC/ Dr. Lyle Conrad; 1976


Zaire - September 1, 1976

- First Case in Yambuku hospital
- 5 syringes/needles
- Sept 30th- hospital closed
  - 11/17 HCW died
- Last case – Nov 5th

318 cases: 280 deaths
88% mortality

Content Providers: CDC/ Dr. Lyle Conrad; Photo Credit: Joel G. Breman, M.D., D.T.P.H; 1976

**Ebolavirus**

- Sudan ebolavirus (SUDV)
- Zaïre ebolavirus (EBOV)
- Taï Forest (Ivory Coast) ebolavirus (TAFV)
- Bundibugyo ebolavirus (BDBV)
- Reston ebolavirus (RESTV)

Mandell, Douglas, and Bennett’s Principals and Practice of Infectious Diseases, Seventh Edition. Gerald L. Mandell, John E. Bennett, and Raphael Dolin. 164, 2259-2263

**Guinea- December 2013**

- Guéckédou, Guinea
  - 2yr old Child
  - Fever, black stool, vomiting
  - Onset Dec. 2, 2013; died Dec. 6, 2013

- Transmitted from HCW (patient #14) to neighboring towns
  - HCW died Feb. 10, 2014

- March 10, 2014 – Guinea Ministry of Health Notified
- March 14, 2014- Outbreak team in place

111 suspect cases: 79 deaths (71% mortality)

August 21, 2014 – Ebola Cases

- Suspected and Confirmed Case Count: 2473
- Suspected Case Deaths: 1350
- Laboratory Confirmed Cases: 1460

Transmission

- Zoonotic - introduced to humans through close contact with infected animal’s bodily fluids
  - Fruit bats
  - Chimpanzees
  - Gorillas
  - Monkeys
  - Forest Antelope
  - Porcupines

Author: Mnolf
GFDL & CC ShareAlike 2.0
Human to Human Transmission

- Direct contact with infected bodily secretions
- Indirect contact with contaminated environments
  - In lab study: Ebola can remain active for up to 6 days
  - Environmental cxns: 2/33 samples positive for Ebola
    - Blood stained physical glove
    - Bloody IV insertion site
- Direct contact with infected corpses
- Men who survive can transmit virus via semen for up to 7 weeks

http://www.who.int/mediacentre/factsheets/fs103/en/

High Risk Exposures

- Percutaneous
  - needle stick or mucous membrane exposure to body fluids
- Direct care or exposure to body fluids without appropriate personal protective equipment (PPE)
- Participation in funeral rites
Low Risk Exposures

- Household member or other casual contact with an EVD patient
- Providing patient care or casual contact without high-risk exposure with EVD patients

Ineffective Transmission

Previous epidemics have calculated that 1 primary human case of Ebola generates only 1 to 3 secondary cases on average.

1 case of Measles in West Africa generates 14-17 cases.


Clinical Manifestations

- Incubation period of 8-10 days (range 2-21)
- Abrupt onset of fever, with HA and myalgia
  - Nausea, vomiting, abdominal pain, and diarrhea
  - Maculopapular rash by day 5-7
  - Chest pain, shortness of breath
  - Hemorrhage
  - Confusion, seizures

Differential Diagnosis

- Malaria
- Typhoid Fever
- Dengue
- Lassa Fever
- Shigellosis
- Meningococcal septicemia
- Plague
- Relapsing fever
- Marburg Virus
- Yellow fever
- Viral hepatitis
- Anthrax
- Chikungunya fever
- Leptospirosis
- Typhus

Pathogenesis

- Monocytes, macrophages, and dendritic cells are infected early
- Virus suppresses type 1 interferon responses and induces cytokine and chemokine release
- Virus replicates, released and migrates to local lymph nodes, travels through the lymphatic system to blood
- Virus disseminated throughout the body


- Lymphocytes undergo apoptosis, which undermines adaptive immunity
- Hepatocellular necrosis $\rightarrow$ DIC
- Adrenal necrosis $\rightarrow$ Impaired Steroid Synthesis  
  $\rightarrow$ Hypotension
- Extensive tissue necrosis and shock
Diagnostic labs tests

• Ebola virus is detectable in blood only after onset of symptoms

• Detectable by real-time RT-PCR between 3 to 10 days post-onset of symptoms

Lab Abnormalities

• Leukopenia
• Thrombocytopenia – 50 to 100K range
• Transminitis: AST>ALT
• Proteinuria may be present
• PT and PTT prolonged
• Fibrin elevated
**Fatal Illness**

- LFTS and D-dimer higher in fatal illness.
- Calcium <6mg/dL associated with death
- Median survival of 9 days
- Most patients die during the second week
- Alive on day 14 portends >75% survival
- Fatally infected patients do not develop an AB response


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**Treatment**

- Supportive care
- Antibiotics for secondary infections
- September 4-5, WHO scheduled conference on potential Ebola therapies and vaccines in Geneva
Additional References

CDC Ebola Hemorrhagic Fever site: www.cdc.gov/ebola


http://www.nejm.org/page/ebola-outbreak

Dr. Margaret Isaacson as she was tending to the needs of an Ebola patient in a Yambuku, Zaire hospital theatre block that was used as a temporary ICU for Ebola patients during the country's 1976 outbreak.

Content Providers: CDC/ Dr. Lyle Conrad; Photo Credit: Joel G. Breman, M.D., D.T.P.H; 1976

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Ebola

Naeem Ali, MD
Medical Director,
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Are you prepared?

Hospital preparedness

EVD

Why prepare?
Why prepare?
Why prepare?

Why prepare?
Why prepare?
Why prepare?

Why prepare?
Potential risks

1. Uncontrolled patient exposure at arrival/pre-identification
2. Inadequate patient isolation
3. Exposure to biological fluid samples

Preparedness: more than patient isolation

Within minutes, he dispatched one member of his staff to make sure that the sick man remained isolated and that doctors and nurses were taking precautions to protect themselves against contracting the virus. Then he turned to a second staff member.

“Stop what you’re doing right now,” Dr. Phillips told him, and sent him to the hospital’s laboratory.

The lab?

NYT, 8/10/2014, Rachel Swarns
Case study: CJD

<table>
<thead>
<tr>
<th>Risk of infection</th>
<th>Tissue</th>
<th>Special procedures</th>
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<tbody>
<tr>
<td>High</td>
<td>Brain, spinal cord</td>
<td>• Notification</td>
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<tr>
<td></td>
<td></td>
<td>• PPE disposal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Laundry disposal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Terminal room cleaning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Disposable equipment use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Special equipment decon. procedures</td>
</tr>
<tr>
<td>Low</td>
<td>CSF, liver, lymph node</td>
<td>• Notification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dedicated instrument</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Usual cleaning after sample assay</td>
</tr>
<tr>
<td>None</td>
<td>Whole blood, nasal mucous, saliva, sputum, feces</td>
<td>• Notification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Usual cleaning after sample assay</td>
</tr>
</tbody>
</table>

EVD comparison

• Blood and secretions are infectious
  – PCR positive in blood only

• Implications
  – Common laboratory testing samples for the febrile patient ARE infectious

• Mitigation?
Potential risks with mitigation

1. Limited standard testing for EVD pts
2. POCT for routine labs
3. Sending out for specialized testing

• Limited standard testing for EVD pts
• POCT for routine labs
• Sending out for specialized testing

• Appropriate isolation
• Emphasis on preventing inadvertent exposure of Mucous membranes
• Limiting access/movement
• Single/cohort rooms

1. Uncontrolled patient exposure at arrival/pre-identification
2. Inadequate patient isolation
3. Exposure to biological fluid samples

• Public signage
• Traveler alerts
• Early provision of PPE
• Expedited triage

• Public awareness
• Public Health Surveillance and guidance

Summary Hospital Preparedness

• Collaborate/Communicate with local Health Department
• Communicate and advertise in public spaces dependent on local burden of international travelers
• Plan for
  – early patient identification/isolation
  – Slow and contained diagnostic testing
• Normal protective equipment
  – Need for complete coverage of mucous membranes
  – Attention for the duration of the treatment period
• Make a personnel plan
  – Special training, reduce myth/mystery, increase education
Ebola HF in the Acute Care Settings

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Objectives for acute presentation of Ebola HF (Hemorrhagic Fever)

1. Identification & Recognition
2. Isolation
3. Medical Treatment

Image from CDC
### Identification of Ebola HF Patients

- **Education of staff**
- **Increased awareness levels at portals of entry**
  - Clinics
  - Urgent care centers
  - Emergency departments
- **Public health awareness**
  - Patient self-selection
  - Signage & outreach

**Screening criteria for Ebola HF in the ED:**
- Any of the following symptoms:
  - Fever >101.5°F
  - Headache
  - Joint / muscle aches
  - Weakness
  - Vomiting
  - Diarrhea

![Image from CDC](image-url)

**Author:** Mikael Häggström. – Public Domain
Identification of Ebola HF Patients

- Ask about travel to high-risk areas <21 days:
  - Guinea
  - Liberia
  - Nigeria
  - Sierra Leone
- Concerning symptoms PLUS high risk travel requires immediate isolation!

Isolation of Ebola HF Patients

- Place a mask on the patient
  - Initiate contact, droplet, & airborne precautions
- Staff personal protective equipment includes:
  - Gown
  - Gloves
  - Mask
  - Eye protection
Isolation of Ebola HF Patients

• Outpatient setting
  – Arrange transfer to ED (via ambulance with PPE)

• Emergency Department
  – Place patient in private room with bathroom
  – Negative airflow not required
  – Contact, Droplet & Airborne isolation precautions
  – Dedicated medical equipment should be disposable when possible

Isolation of Ebola HF Patients

• Notifications:
  – ED Attending
  – Critical Events Officer
  – Infectious Disease Team
  – Public Health Department (via the CE Officer)
    • This notification chain is institution dependent

• Initiation of laboratory testing
Acute Medical Treatment of Ebola HF

- Supportive therapy:
  - Fluids and electrolytes
  - Blood pressure and oxygen status
  - Treatment of complicating infections
- Initial management of complications
- Admission to the inpatient setting
  - Level of care depends on acuity of illness