EMERGING INFECTIOUS DISEASE (EID) FRONTLINE FACILITY TRAINING

AMI BOONJALUKSA, RN
LOS ANGELES COUNTY EMS AGENCY
OBJECTIVES

1. Explore emerging infectious diseases of concern that may warrant treatment in a biocontainment unit (BCU)
2. Be familiar with the Three-tiered Approach and LA County’s EID Activation and Response Plan
3. Develop systems to mitigate the potential spread of an emerging, highly infectious disease when a patient self presents to a frontline healthcare facility
4. Learn waste management procedures for Category A substances
5. Learn PPE donning and doffing principles for viral hemorrhagic fevers
The information presented here was taken from ASPR TRACIE’s Frontline Hospital Planning Guide for Special Pathogens developed to assist frontline facilities to effectively Identify, Isolate, and Inform when a suspected case presents to an acute care facility. I, nor the authors of the guidebook, take no responsibility and bear no liability for any clinical care outcomes, provider injury/illness, or inaccuracies in or resulting from this training.
EMERGING INFECTIOUS DISEASE/SPECIAL PATHOGENS

Diseases that are:
- Recognized in the human host for the first time
- Reappear after apparent control or elimination
- Infectious, highly hazardous, and communicable
Pathogens that might warrant care in the BCU or other specialized care areas

- Viral Hemorrhagic Fever Viruses
- Airborne Agents Causing Severe Respiratory Syndromes
  - Eg. SARS, MERS, novel influenza
- Certain Orthopoxviruses
  - Smallpox, monkeypox
- A Few Miscellaneous Pathogens (Nipah, Hendra)
- Pathogens Raising Political or Assuredness Concerns
- Andromeda... the unknown pathogen
2017-2019 SPECIAL PATHOGEN OUTBREAKS

Lassa

MERS

Monkeypox

Nipah

Marburg

Ebola

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
Global travel means the next special pathogen is a flight away
MODE OF TRANSMISSION

Contact or Fomites:
- Ebola: Marburg
- Lassa: Other VHF
- Variola: Monkeypox
- MERS?
- SARS?

Droplets:
- Ebola?
- SARS
- MERS
- Nipah
- Influenza
- Monkeypox?
- Marburg?
- Hendra?

Droplet Nuclei:
- Variola
- SARS?
- MERS?

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
# VIRAL HEMORRHAGIC FEVERS

<table>
<thead>
<tr>
<th>Filoviruses</th>
<th>Arenaviruses</th>
<th>Bunyaviruses</th>
<th>Flaviviruses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebola</td>
<td>Lassa</td>
<td>CCHF</td>
<td>RSSE</td>
</tr>
<tr>
<td>Marburg</td>
<td>Lujo</td>
<td></td>
<td>CEE</td>
</tr>
<tr>
<td></td>
<td>Junin</td>
<td>Hantavirus</td>
<td>TBE Complex</td>
</tr>
<tr>
<td></td>
<td>Machupo</td>
<td></td>
<td>Kyasanur</td>
</tr>
<tr>
<td></td>
<td>Guanarito</td>
<td></td>
<td>Forest Omsk</td>
</tr>
<tr>
<td></td>
<td>Sabia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Red = transmissible from PTP; Green = transmissible only via rodents or arthropod vectors*

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
VHF Misconceptions

- They all have the same features
- They all spread easily
- They are easily recognizable
- Bleeding is the primary cause of death

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
EBOLA IN THE DEMOCRATIC REPUBLIC OF THE CONGO (DRC)

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
Confirmed and probable Ebola virus disease cases by week of illness onset, data as of December 2019

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
WHAT DO WE KNOW ABOUT EBOLA?

- Average mortality rate in Africa is 50%\(^1\)
  - Lack of supportive care and technological medical advancements
  - Resource poor nations
- Spread through direct contact
- Symptoms usually appear 8-10 days after exposure, but the incubation period can span up to 21 days
- People are not infectious until they develop symptoms
- Virus remains persistent even after recovery

**Table 1. Common symptoms, signs, and laboratory test abnormalities in Ebola virus disease***

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
<th>Laboratory Test Abnormalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever (87%)</td>
<td>Elevated temperature</td>
<td>Leukopenia—leukocytosis, atypical lymphocytosis</td>
</tr>
<tr>
<td>Fatigue (76%)</td>
<td>Pulse temperature dissociation</td>
<td>Thrombocytopenia</td>
</tr>
<tr>
<td>Vomiting (68%)</td>
<td></td>
<td>Transaminitis (AST&gt;ALT)</td>
</tr>
<tr>
<td>Diarrhea (66%)</td>
<td></td>
<td>Hyponatremia</td>
</tr>
<tr>
<td>Loss of appetite  (65%)</td>
<td></td>
<td>Hypokalemia</td>
</tr>
<tr>
<td>Headache (53%)</td>
<td></td>
<td>Hypocalcemia</td>
</tr>
<tr>
<td>Abdominal pain    (44%)</td>
<td></td>
<td>Elevated BUN and creatinine</td>
</tr>
<tr>
<td>Arthralgias (39%)</td>
<td></td>
<td>Lactic acidosis</td>
</tr>
<tr>
<td>Myalgias (39%)</td>
<td></td>
<td>Prolonged INR and PTT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypoalbuminemia</td>
</tr>
</tbody>
</table>

CARING FOR VHF

Multidisciplinary team

- Pre-hospital care team
- Nurses
- MDs
- Infection Control/EVS/Lab/ Respiratory therapists/Pharmacy
- Office of the Chief Medical Examiner
- Collaboration with infectious disease- NIH/CDC
- Department of Health
TREATMENT

• Early rehydration
• Oxygen therapy
• Supportive care
• Antibiotics to treat other infections
• Continuous renal replacement therapy (CRRT)
• Zmapp, Mab114, REGN-EB3
• Preventative – ERVBO vaccine
## BEYOND VHF: OTHER SPECIAL PATHOGENS

<table>
<thead>
<tr>
<th>Family</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronaviruses</td>
<td>SARS, MERS-CoV</td>
</tr>
<tr>
<td>Avian &amp; Novel Influenza Viruses</td>
<td>H7N9</td>
</tr>
<tr>
<td>Henipaviruses</td>
<td>Nipah, Hendra</td>
</tr>
<tr>
<td>Orthopoxviruses</td>
<td>Smallpox, Monkeypox</td>
</tr>
</tbody>
</table>

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
RESPIRATORY ILLNESSES

The Coronaviruses

Can produce Life-threatening illness

MERS
SARS

229E
NL63
OC43
HKU1

Causes of the Common Cold

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
SEVERE ACUTE RESPIRATORY SYNDROME (SARS)

- Produces severe lower respiratory tract illness
- Appeared in China in 2002
- Ultimately affected 37 nations, including US & Canada
- No reported cases since 2004
- 8273 total cases recorded
  - 775 deaths
  - 27 US cases (no deaths)
- Overall mortality was 9.6%

Source: NTIDC Emerging Infectious Disease Preparedness Training Workshop 12/2019
CLINICAL MANIFESTATIONS OF SARS

- Incubation period 2-7 days
- Presents with flu-like symptoms with fever > 100.4
- Headache
- Body aches
- Diarrhea
- Pneumonia
A new virus related to SARS is the culprit in China's mysterious pneumonia outbreak, scientists say

By Nectar Gan, CNN

Updated 5:38 AM ET, Thu January 9, 2020
# 2019 Novel Coronavirus (2019-nCoV)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Symptoms</th>
<th>Additional Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fever <em>and</em> symptoms of respiratory illness (cough, SOB, etc)</td>
<td>-AND-&lt;br&gt;History of travel to Wuhan within 14 days&lt;br&gt;-OR-&lt;br&gt;Within 14 days, close contact(^1) with <em>possible</em> 2019-nCoV patient while patient was ill.</td>
</tr>
<tr>
<td>2</td>
<td>Fever <em>or</em> symptoms respiratory illness (cough, SOB, etc)</td>
<td>-AND-&lt;br&gt;Within 14 days, close contact(^1) with <em>lab confirmed</em> 2019-nCoV patient while patient was ill.</td>
</tr>
</tbody>
</table>

\(^1\)Close contact: within 6 feet or within room of a 2019-nCoV case while not wearing PPE. Living with a case, visiting, sharing waiting room or room. Or contact with respiratory secretions.
CONFIRMED GLOBAL CASES OF MERS-COV 2012 - 2017

Novel Coronavirus Transmission

- Cross-species transmission
- Zoonotic transmission
- SARS-CoV
- MERS-CoV
- Health care personnel
- Nosocomial transmission
- Hospital patient
- Other patient
- Palm civets and other animals traded in live-animal markets
- Community contact
- Rare

NOVEL INFLUENZA VIRUSES

- Four types: A, B, C, & D
- Type A & B - seasonal epidemics during winter
- Type C cause mild illness
- Type D affect cattle and not humans
- Influenza A
  - H1N1, H7N9, H5N1, H3N2
  - Linked to flu pandemics: Spanish flu of 1918, H1N1 in 2009
Risk Factors for Novel Influenza Emergence

- Pigs harbor human strains
- Pigs harbor avian strains
- Pigs thus serve as "mixing vessels"
- Antigenic shift occurs in the pig
- The fear: a new virus with human affinity and avian mortality

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
HENIPAVIRUSES

- Hendra and Nipah Viruses
- Bats are reservoir
- Incubation period 5-16 days
- Symptoms: Influenza-like
- Causes fatal encephalitis in humans

Blue = Nipah
Red = Hendra
ORTHOPOXVIRUSES: SMALLPOX AND MONKEYPOX
SMALL POX

- Dates back to Egyptian Empire – 3rd century BC
- Last naturally occurring outbreak in 1977
- Declared eradicated since 1980 due to worldwide vaccination campaign to eradicate the disease
MONKEYPOX

- Endemic to Central and West Africa
- Incubation period 7-14 days
- S/S begins with fever, headache, muscle aches, fatigue, swollen lymph nodes; rash develops 1-3 days after fever onset
- Transmission: contact & droplets
- 47 cases in the United States in 2003

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
Disease X (aka The Andromeda Strain)

Patients with unknown diseases could be admitted to a Biocontainment Unit

At the time of their initial outbreaks, these could have been “Andromeda Strains”

- Nipah
- Hendra
- SARS
- MERS
- Sin Nombre
- Many others

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
### PERSONAL PROTECTIVE EQUIPMENT

<table>
<thead>
<tr>
<th>Type of Precautions</th>
<th>PPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>gloves, gown, simple mask(^1), goggles or face shield (exact ensemble determined by the type of clinical interaction with the patient and patient signs and symptoms)(^2,3)</td>
</tr>
<tr>
<td>Contact</td>
<td>fluid-resistant gown, gloves(^2)</td>
</tr>
<tr>
<td>Droplet</td>
<td>simple mask, eye protection (eye protection not required but recommended by most sources)(^2)</td>
</tr>
<tr>
<td>Airborne</td>
<td>fit-tested N95 or equivalent/higher respirator or powered air-purifying respirator (PAPR)(^2,4)</td>
</tr>
</tbody>
</table>
Hierarchy of Controls

1. **Elimination**
   - Physically remove the hazard

2. **Substitution**
   - Replace the hazard

3. **Engineering Controls**
   - Isolate people from the hazard

4. **Administrative Controls**
   - Change the way people work

5. **PPE**
   - Protect the worker with Personal Protective Equipment

Source: NETEC Emerging Infectious Disease Preparedness Training Workshop 12/2019
SPECIAL PATHOGEN LEVEL 1 PPE

- Fit tested N95 mask
- Fluid resistant gown that extends to mid-calf
- Nitrile gloves with extended cuffs – 2 pairs
- Face shield
- Consider boot covers and head cover