FMD Current Epidemic Situation in China

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Contains

• Introduction of CNFMDRL briefly

• Current situation of FMD in China
  – Type O (2011)
  – Threatened outbreaks or strains from neighboring countries

• Diagnostic techniques

• FMD routine surveillance & active monitoring

• Future directions and needs
China National Foot-and-Mouth Disease Reference Laboratory

- Founded in 1958: FMD research group
- Renamed as NFMDRL by MoA of China in 2002
- OIE FMDRL in May, 2011
- Centre of FMD diagnosis, research, consulting service in China
Roles of CNFMDRL

Diagnosis
- Final diagnosis;
- R&D new methods;
- Standardization of detection methods;
- Supply reagents

Vaccination
- Evaluation of immune effect in field;
- Detection of antigenic variation of field isolates;
- Screening and recommendation of vaccine strains

Regional Technical Assistance
- Provide technical consultation and instruction;
- Participate in drawing policies and plans for FMD prevention and control;
- Training

Technical consultation
- Epidemiological survey
- ......
Current situation of FMD in China

Regional pool covered
Pool 1 & Pool 2

Map of world with various pools marked:
- Pool 1: O, A, Asia 1
- Pool 2: O, A, Asia 1
- Pool 3: O, A, Asia 1
- Pool 4: O, A, SAT1,2,3
- Pool 5: O, A, SAT1,2
- Pool 6: O, A, SAT1,2,3
- Pool 7: O & A

Legend:
- OIE Reference Laboratories and Collaborating Centres
- FAO Additional Reference Centres
- Regional/National Reference Centres
FMD outbreaks occurred in 2011 in Chinese mainland

- 7 outbreaks covered 4 provinces were confirmed and reported to OIE.
- All of them are serotype O.
- There are 2 serious regions in China: Northwest & Southwest
Gene sequencing

- Mya-98 Strain n=2
- PanAsia Strain n=5

- One epidemic PanAsia strain collected from Guizhou Province VP1 sequence was submitted to GeneBank (Accession Number is JF837375).
- The virus were very closely related to recent viruses from SEA nations, such as Vietnam, Cambodia and Thailand.
- No other topotype strains (CATHAY) or PanAsia-2 strain were found in chain mainland.
<table>
<thead>
<tr>
<th>Report Date</th>
<th>Type</th>
<th>Species</th>
<th>Location</th>
<th>Province</th>
<th>Strain</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/02/2011</td>
<td>O</td>
<td>Swine</td>
<td>Qia'erbagexiang, Kuerle, Bazhou, XINJIANG</td>
<td>XINJIANG</td>
<td>mya-98</td>
</tr>
<tr>
<td>28/03/2011</td>
<td>O</td>
<td>Swine</td>
<td>Xinjiang Production and Construction Corps, XINJIANG</td>
<td>XINJIANG</td>
<td>mya-98</td>
</tr>
<tr>
<td>07/04/2011</td>
<td>O</td>
<td>Cattle</td>
<td>Jing Xiang village, Tianzhu, Qian dongnan, GUIZHOU</td>
<td>GUIZHOU</td>
<td>PanAsia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sheep / goats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Swine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21/07/2011</td>
<td>O</td>
<td>Cattle</td>
<td>Longfeng village, Pudi, Bijie, GUIZHOU</td>
<td>GUIZHOU</td>
<td>PanAsia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Swine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sheep / goats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/09/2011</td>
<td>O</td>
<td>Cattle</td>
<td>Liebugou, Lengda village, Jiacha, Shannan, TIBET</td>
<td>TIBET</td>
<td>PanAsia</td>
</tr>
<tr>
<td>10/10/2011</td>
<td>O</td>
<td>Cattle</td>
<td>Duixu village, Zhongda town, Lang, Linzhi, TIBET</td>
<td>TIBET</td>
<td>PanAsia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sheep / goats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Swine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17/10/2011</td>
<td>O</td>
<td>Cattle</td>
<td>Shuangjing village, Haiyuan, Zhongwei, NINGXIA</td>
<td>NINGXIA</td>
<td>PanAsia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sheep / goats</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Nowadays, the main threat comes from affecting of O/Mya-98 strain and PanAsia strain. The O/Mya-98 strain mainly affect pigs, although cattle and goat/sheep can also show clinical signs in some field cases. However, the PanAsia strain mainly affect cattle.

Epidemiological analysis indicates that animal movements associated with trade are the main factors for the spread of the FMD and for transmission between provinces in China.

After Sep, 2010, the frequency of cases has trended to be decreasing.

Both Mya-98 and PanAsia strains of FMD sequences from PR China was a close relationship with those sequences from outbreaks in Southeast Asia nations.
Situation-Serotype A

- On January 2009, FMD cases due to serotype A were recognised in Hubei province and Shanghai.
- Prior to the new cases, serotype A had not been reported in PR China.
- 7 cases have been occurred during 2009; and from Jan to Feb 2010, 2 new outbreaks of A serotype were confirmed in Xinjiang, 1 sub-clinical infection was found in routine surveillance in Beijing.

About 24 months from March 2010 to now, No new outbreaks of type A were found in China.
The information of FMDV type A reported to OIE from China

<table>
<thead>
<tr>
<th>Date</th>
<th>Species</th>
<th>Susceptible</th>
<th>Cases</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>22/01/2009</td>
<td>Cattle</td>
<td>294</td>
<td>58</td>
<td>Sunwan, Dongxihu, Wuhan, HUBEI 1</td>
</tr>
<tr>
<td>12/02/2009</td>
<td>Cattle</td>
<td>440</td>
<td>41</td>
<td>Wusi, Fen Xian, SHANGHAI 2</td>
</tr>
<tr>
<td>30/04/2009</td>
<td>Cattle</td>
<td>413</td>
<td>17</td>
<td>Congcong, Wujing, Changzhou, JIANGSU 3</td>
</tr>
<tr>
<td>22/05/2009</td>
<td>Cattle</td>
<td>184</td>
<td>12</td>
<td>Xi'nan, Lin'gui, Guilin, GUANGXI 4</td>
</tr>
<tr>
<td></td>
<td>Swine</td>
<td>570</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>22/05/2009</td>
<td>Cattle</td>
<td>78</td>
<td>71</td>
<td>Haixing chaoyang village, Pan, Liupanshui, GUIZHOU 5</td>
</tr>
<tr>
<td></td>
<td>Swine</td>
<td>19</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>08/06/2009</td>
<td>Cattle</td>
<td>290</td>
<td>33</td>
<td>Bingzhou, Bingcheng district, Bingzhou, SHANDONG 6</td>
</tr>
<tr>
<td>25/11/2009</td>
<td>Cattle</td>
<td>1408</td>
<td>321</td>
<td>Fukang City, Changji Prefecture, XINJIANG 7</td>
</tr>
<tr>
<td>15/01/2010</td>
<td>Cattle</td>
<td>37</td>
<td>28</td>
<td>Xi'nier town, XINJIANG</td>
</tr>
<tr>
<td>22/01/2010</td>
<td>Cattle</td>
<td>575</td>
<td>23</td>
<td>Longtou village, Lixian town, Daxing district, Beijing 8</td>
</tr>
<tr>
<td>02/02/2010</td>
<td>Cattle</td>
<td>44</td>
<td>26</td>
<td>Beicheng county, XINJIANG</td>
</tr>
<tr>
<td></td>
<td>Sheep</td>
<td>125</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Molecular epidemiological analysis

VP1 sequencing showed that the viruses involved have a common source and are different from the historical Chinese strains of type A FMD virus.

The VP1 sequences of A/HuB/WH/2009 and A/SH/2009 are related to some published VP1 sequences of A/May/02 (95.9%), A/Tai/07 (95.7%) and A/Lao/8/06 (95.3%), and a comparison with WRLFMD sequence data revealed a strong similarity to A/Tai/08 virus, indicated that the virus may have been introduced from Southeast Asia.
More susceptible animals

OUTBREAKS OCCURRED IN CHINA (2005~2009)

- 46 outbreaks
- 17 provinces

NUMBER

YEAR

2005 2006 2007 2008 2009 2010

10 17 8 8 7

Outbreak Province
VP1 gene sequences, showing the relationships between Aisa1 FMDV from Asia region.

FMD virus from China during 2005-2009 are belong to South Asia topotype, Group V. They were very closely related to virus from India collected in 1980-81. While little related to the sequence in 1958 in China.

According to the information from FAO/OIE, during 1998-2004, 12 countries in Asia were affected with Asia1 virus.

These implies that the isolates were spread from other countries.

The source of FMDV type Asia1 (molecular epidemiology)
Incursions of Southeast Asian Foot-and-Mouth Disease Viruses into East Asia
Nick, Jijun and Don
Emerging Infectious Diseases
• Thus for both O and A serotypes, sequence data implicate FMD endemic parts of mainland Southeast Asia as the source of FMD viruses that have caused recent outbreaks in East Asia.

• *In vitro* vaccine matching data (from IAH) indicates that currently available vaccine strains (A/May/97 and O/Manisa) should protect against representative isolates from these two serotypes.

• However, close monitoring of the antigenicity and spread of these Southeast Asian lineages is now essential to ensure the risks of further and continued outbreaks can be mitigated.
## Hong Kong SAR

### Official name:
**Hong Kong Special Administrative Region of the People's Republic of China**

### FMD eradicated:
No

### Subsequent outbreaks:

### Current status:

### Useful websites:

#### Serotype
- **FMDV-Untyped:**
  - 2010
- **FMDV-O:**
  - 0000
- **FMDV-A:**
  - 0000
- **FMDV-Aba:**
  - 0000
- **FMDV-SAT 1:**
  - 0000
- **FMDV-SAT 2:**
  - 0000
- **FMDV-SAT 3:**
  - 0000

### Table of FMD Outbreaks

<table>
<thead>
<tr>
<th>Year</th>
<th>Date</th>
<th>Code</th>
<th>Serotype</th>
<th>Location</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>05/03/2010</td>
<td>WRLFMD/2010/00009</td>
<td>FMDV-GD</td>
<td>HKN/12/2010</td>
<td>SEA Mya-98</td>
</tr>
<tr>
<td>2010</td>
<td>16/03/2010</td>
<td>WRLFMD-2010-00010</td>
<td>O</td>
<td>HKN/21/2010</td>
<td>nd nd</td>
</tr>
<tr>
<td>2010</td>
<td>23/03/2010</td>
<td>WRLFMD/2010/00013</td>
<td>O</td>
<td>HKN/22/2010</td>
<td>nd nd</td>
</tr>
<tr>
<td>2010</td>
<td>23/03/2010</td>
<td>WRLFMD/2010/00013</td>
<td>FMDV-GD</td>
<td>HKN/23/2010</td>
<td>- -</td>
</tr>
</tbody>
</table>
| 2010 | 08/12/2010 | WRLFMD/2010/00047 | O | HKN/24/2010 | CATHAY O

Note: The dates and codes represent specific FMD outbreaks in Hong Kong SAR during the specified years.
Hong Kong and Taiwan

- Pig-adapted type O FMDV reappeared in swine herds in 2009.
- 8 outbreaks being found in 2009.
- Vaccination program resumed in August 2009.
- 4 outbreaks have been found in 2010.
- 9 outbreaks have been found in 2011.
Threatened outbreaks or strains from neighboring country

A/Iran/05
O/PanAsia-2
Asia1/GVII?

O/Mya-98

O/Mya-98
O/PanAsia
A/ASIA
Diagnostic techniques

- Identification of the agent
  - Virus Isolation
  - FMD Serotyping ELISA
  - FMD Serotyping RT-PCR
  - FMD multiplex RT-PCR
  - FMD real-time RT-PCR
  - FMDV VP1 sequencing and molecular epidemiology
- Other Techniques for Identification of The Agent
  - Complement Fixation Test (CFT)
  - Reverse Indirect Hemagglutination Assay (RIHA)
  - VNT with reference serum
  - FMD RT-LAMP
  - Colloid-gold test strips
• FMD Immune Antibody Detection Technique
  - LPB-ELISA
  - SPC-ELISA
  - IHA
  - Colloid-gold test strips
• FMD Infected Antibody Detection Technique
  - FMDV NSP-3ABC ELISA
  - FMDV NSP-2C3AB ELISA
  - FMDV NSP-2C3AB antibody colloid-gold test strips
  - Dot-ELISA
FMD routine surveillance & active monitoring in 2011

- From 15th April to 15th June 2011, an active, routine and large-scale epidemiological survey was organized and implemented with China Animal Disease Center under direction of Veterinary Bureau of MoA, China.
- The monitoring activity covered seven provinces: Yunnan, Guangxi, Guizhou, Guangdong, Hunan, Sichuan, and Chongqing, in southwest of China.
- Covered 87 sampling sites in 28 counties.
- Collected 2198 sera and 2011 etiology samples (ruminant OPF and pig submaxillary lymph nodes).
- Valuable for FMD prevention and control in above zones (data not shown).
Sampling counties
• 4 emergency epidemiological surveys were carried out in Xinjiang Autonomous Region, Guizhou Province and Tibet after FMD outbreaks in 2011;
• Quarterly monitoring for Hainan Island FMD-free zone with immunization was kept implementing;
• Yongji, Jinlin province, FMD free zone with vaccine (building), technique support by NFMDRL
Future directions and needs

- Take an active part in PCP for FMD control as OIE RL
- SEACFMD Campaign
  - Joined in 2010
  - SEACFMD 2020 Roadmap
• In 2012, a systematic epidemiological survey will be held across the border area in Xinjiang Autonomous Region.
Needs

• More information of FMD situation and strains
  – Strengthen disease information sharing
  – risk evaluation
  – FMD surveillance, especially ecological distribution of virus and disease prevalence

• Cooperation (Epidemiology/Information exchange, Joint control, Research/Project…)

• Training (lab diagnostic methods, field epidemiology training…)

[Logos]
Thank you

Welcome to Lanzhou Veterinary Research Institute