Epidemiological situation of rabies in South Korea

Dong-Kun Yang/ OIE expert for rabies & JE

2018.10.17

2018 Launching Meeting of OIE Twinning project for rabies between Ances-Nancy and AHRI
Animal & Plant Quarantine Agency located in Gimcheon city

APQA moved from Anyang city to Gimcheon city in 2016.
Organization Chart of APQA

APQA Commissioner (1058)
(Animal & Plant Quarantine Agency)

General Service Division (34)

Planning & Coordination Division (15)

Dep. Animal Disease Control (168)
- Animal Disease Control
- Animal Quarantine
- Veterinary Epidemiology
- Animal Disease Diagnostic
- Import Risk Assessment
- Animal Protection & Welfare
- Veterinary Pharmaceutical Management
- Veterinary Medicine & Biologics
- Animal Disease control center

Dep. Plant Quarantine (73)
- Plant Quarantine
- Export Management
- Risk Management
- Plant Pest Control
- Plant Quarantine Technology

Dep. Animal & Plant Health Research (101)
- Research Planning
- Bacterial Disease
- Viral Disease division
- Foot and Mouth Disease
- Avian Disease
- AI research diagnosis
- Foreign Animal Disease
- Center for FMD Vaccine center
Location of six regional Office

- Incheon Intl. Airport
- Seoul
- Jungbu
- Honam
- Yeongnam
- Jeju
Six major missions of APQA

- Import/export quarantine and inspection of animal, livestock products, plant, and plant products
- Control and prevention of animal diseases such as FMD, AI
- Surveillance, control and import risk analysis of exotic plant pests
- Animal protection and welfare
- Quality control and safety management of veterinary biologicals
- Research and development of veterinary science and plant quarantine technology.
Seven Reference Laboratory, APQA

**Designation of OIE Reference Laboratory**

- Brucellosis
- Newcastle Disease
- Chronic Wasting Disease
- Rabies
- Japanese Encephalitis
- Foot & Mouth Disease
- Salmonellosis

**2009**
- OIE twining program with Fiji.
- Negligible risk in Korea (0.02%, ’16)

**2010**
- Preparing disease-free country in 2017 (no cases since June 2010)

**2012**
- Strengthened Diagnosis training program in Asia
- 2020 Rabies eradication program

**2013**
- Strengthening a role as the only one OIE reference lab in the world
- Center for FMD research in pig.
- Preparing joint meeting with OIE Ref. Labs in Asia.

**2016**
- Monitoring

**2017**
- 2020 Rabies eradication program

- Center for FMD research in pig.
- Preparing joint meeting with OIE Ref. Labs in Asia.

- Monitoring
### Reference Laboratories, QIA
### Infectious Diseases designated by OIE

#### 7 Ref Labs, 47 staffs (Budget 2017: US$ 4,430,000)

<table>
<thead>
<tr>
<th>Infectious Disease</th>
<th>Designated Year</th>
<th>OIE expert</th>
<th>Manpower</th>
<th>Budget 2017</th>
</tr>
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<tbody>
<tr>
<td>Brucellosis</td>
<td>May 2009</td>
<td>Dr. Moon Her</td>
<td>6</td>
<td>US $280,000</td>
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<tr>
<td>Newcastle Disease</td>
<td>May 2010</td>
<td>Dr. Kang Seuk Choi</td>
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<tr>
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<td>May 2017</td>
<td>Dr. Min Soo Kang</td>
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<td>US $210,000</td>
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</table>
Reference Laboratories, QIA
Laboratory Quality Assurance System

QA system: ISO/IEC* 17025
Organization: ILAC-MRA**
Accreditation (for diagnostic methods):
  • Brucellosis (2008)
  • Rabies (2012)
  • Japanese Encephalitis (2014)
  • Newcastle Disease (2014)
  • Chronic Wasting Disease (2014)
  • Foot and Mouth Disease (2014)
  • Salmonellosis (2016)

** International Laboratory Accreditation Cooperation-Mutual Recognition Arrangement
**International Proficiency test 2017**

**Brucellosis** by ANSES, France
- EU Bovine Brucellosis Serum Proficiency Test 2014 (RBT, SAT, iELISA)

**Newcastle Disease** by APHA, UK
- 2015 EU Conventional Proficiency Ring trial (AI/NDV PCR and classical HI typing)

**Chronic Wasting Disease** by AHVLA, UK
- Diagnostic protocol for rapid test of TSE (Ag ELISA, Immunoblot)

**Rabies** by ANSES, France
- EU Rabies FAVN proficiency test

**Salmonellosis** by APHA, UK
- 2017 EU Conventional Proficiency test (Avian salmonellosis)

**Brucellosis** by QIA, Korea
- Diagnosis and differentiation of brucellosis (Participant: Thailand, Mongolia)
Reference Laboratories, QIA
Scientific and Technical Training

1st Workshop: 20 participants from 11 Asian countries (23 Oct 2012 to 2 Nov 2016)
2nd Workshop: 19 participants from 11 Asian countries (14 Oct 2013 to 25 Oct 2013)
3rd Workshop: 20 participants from 11 Asian countries (9 June 2014 to 20 June 2014)
4th Workshop: 10 participants, Vietnam (in Korea) (19 April 2015 to 2 May 2015)
5th Workshop: 9 participants from 4 Asian countries (10 Oct 2016 to 21 Oct 2016)
6th Workshop: 10 participants from 5 Asian countries (5 Sep 2017 to 13 Sep 2017)
7th Workshop: 12 participants from 4 Asian countries (6 Sep 2018 to 14 Sep 2018)
Scientific and Technical Training for rabies and JE in 2018

Technical training including FAVN, FAT and RT-PCR for rabies and ELISA for JE has given to Asian veterinarians in OIE reference labs for rabies and JE every year.
Animal rabies cases and vaccines in Korea since 1907

- Live attenuated rabies vaccine, inactivated rabies vaccine and bait vaccines have been used for the prevention of animal rabies in Korea since 1980.
- What was the cause that had not occurred for ten years until 1992, but that occurred continuously every year thereafter?
In total, 437 animal rabies cases in five animal species have been identified in Korea since 1993.

In total, six human rabies cases were confirmed between 1999 to 2004. Human rabies has not been reported in Korea since 2005.
As raccoon dogs transmit animal rabies in Korea, the Veterinary Authority decided to distribute a rabies bait vaccine in 2000. The injectable vaccine has been distributed to all municipal governments where the vaccine is injected into dogs and cattle via intramuscular route.

What is the effect of distributing bait vaccine?
Distribution of animal rabies cases according to species in Korea since 1993

Of the five animals, cattle (221 heads) were the most common rabies victims.
Raccoon dogs tried to come down for finding out food in winter season. The rabid animals have a tendency to fight domestic or pet animals.
Rabies cases in Korea since 1993 according to regions

Most animal rabies cases occurred around DMZ, assuming that rabies originated from the north. The latest animal rabies was identified in Hwaseoung-si in 2013.
Phylogenetic analysis based on **N** gene using 14 Korean rabies viruses isolates during 2010-2013

Specific nucleotide substitution of Hwaseong isolates: nt 545(T⇒C, aa 182 V→A), 567(G⇒A), 798(G⇒A)
RABV containing Arginine at position 333 in the glycoprotein gene indicates strong virulence in animals

<table>
<thead>
<tr>
<th>Isolates</th>
<th>26</th>
<th>37</th>
<th>310</th>
<th>319</th>
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<th>346</th>
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<td>TWNEIIPSKGCL</td>
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<td></td>
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<td></td>
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<tr>
<td>KRVC0802</td>
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</tbody>
</table>

- Dashes indicate amino acids agreeing with the KRVR0801 isolate.
- Numbers represent amino acid positions of the ectodomain of glycoprotein.
Sero-surveillance of rabies in dogs in two rabies risk regions

A dog living in Gangwon has slightly higher positive rate against rabies than that in Gyeonggi.
Sero-surveillance of rabies in cattle in two rabies risk regions

Cattle rearing in Gangwon has higher positive rate against rabies than that in Gyeonggi. **Warning is given to the cities that shows a low sero-positive rate.** Are the measures to promote vaccination for cattle advanced?
Detection of viral infections in wild Korean raccoon dogs (Nyctereutes procyonoides koreensis)

Dong-Kun Yang, Seoung Heon Lee, Ha-Hyun Kim, Jong-Taek Kim, Sangin Ahn, In-Soo Cho

1Animal and Plant Quarantine Agency, Ministry of Agriculture, Food and Rural Affair, Gimcheon 39660, Korea
2College of Veterinary Medicine, Kangwon National University, Chuncheon 24341, Korea

In total, 62 brain samples of raccoon dogs were examined for rabies virus (RABV) and CDV, and 49 lung samples were screened for CDV, CAdV-2, CPIV-5, and CHV. No RABV, CAdV-2, CPIV-5, or CHV was identified, but nine CDV antigens (8.1%, 9/111) were detected.

Detection of canine distemper virus (CDV) in Korean raccoon dog brain samples (E). Lanes 1–10, brain samples; P, positive sample. Samples 1 and 7 showed positive reactions against CDV.
Sero-positive rates of rabies in several wild animals in South Korea

- Animals were caught from two provinces where rabies bait vaccine has been distributed since 2000 and rabies antibody was measured by FAVN.
- Only 13.7% of raccoon dogs have rabies antibody, indicating that new methods to distribute bait vaccine be needed. In addition, different oral vaccines for rabies may be introduced to rabies risk regions.

<table>
<thead>
<tr>
<th>Species</th>
<th>Positive rate(%)</th>
<th>No. posi/samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild cat</td>
<td>0</td>
<td>0/5</td>
</tr>
<tr>
<td>Badger</td>
<td>33.3</td>
<td>1/3</td>
</tr>
<tr>
<td>Ferret badger</td>
<td>33.3</td>
<td>1/3</td>
</tr>
<tr>
<td>Raccoon dogs</td>
<td>13.7</td>
<td>21/153</td>
</tr>
<tr>
<td>Stray dog</td>
<td>57.5</td>
<td>23/40</td>
</tr>
<tr>
<td>Stray cat</td>
<td>0</td>
<td>0/9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>21.6</td>
<td>46/213</td>
</tr>
</tbody>
</table>

[Bar chart showing positive rates for each species]
The number of dogs showing each viral neutralizing antibody titer against rabies virus in 78 Korean military working dogs. The VNA titers (0.29 and 0.06 IU/mL) of 2 dogs were lower than protective level (0.5 IU/mL) among 4 military dogs born in 2014.
Characterization of Korean raccoon dog

- Family Canidae, *Nycteeutes procyonoides koreensis*
- Name: Korean Raccoon dog
- Distribution in Korea: all provinces except Jeju
- Distribution in other country: North Korea, China, Japan, Russia, Vietnam, North America
- Size: body 50-68 cm, tail 13-20 cm
- Characterization: try to hibernate, act in darkness
- Introduction of Korea: In order to get fur from Russia in 1928, but become a wild animal now
- Food: omnivorous animal, rat, reptile, frog, insect, fruit
- Inhabitation: live around small river, and in a hill
Raccoon dog’s life and new bait vaccine

Korean raccoon dogs have high intelligence and do not bark.
Density of raccoon dogs in rabies risk regions

Recently, density of raccoon dogs have increased in Gaingwon province. Is it possible to reduce the number of susceptible raccoon dogs? Is there any prospect of a joint rabies study between South and North Korea?
Conclusions

• Continuous implementation of rabies control program with mass vaccination for dogs and ongoing distribution of rabies bait vaccine for raccoon dogs will lead Korea to rabies free country.

• For the declaration of rabies free country, active surveillance on suspected dogs and raccoon dogs residing in rabies risk regions should be strengthened.

• Prohibiting the smuggling of animals from other countries is needed.
Thank you for your attention

• Acknowledgements

• Dr. Kim HH