Helminthic food-borne infection in Japan

Raw meat consumption as a risk factor for zoonotic roundworm infections

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Department of Veterinary Sciences,
Faculty of Agriculture, University of Miyazaki
Details of seropositive cases diagnosed by ELISA in Faculty of Medicine, University of Miyazaki

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Larva migrans syndrome (LMS) is a clinical syndrome in humans caused by the migratory larvae of parasites.

**Causative species**

- *Toxocara canis*
- *Toxocara cati*
- *Ascaris suum*

This syndrome involves parasites from the families *Toxocara* and *Ascaris*, which are typically found in dogs, cats, and pigs, respectively.
What is ascarid LMS?

Definitive hosts: Ascaris suum, Toxocara canis, Toxocara cati

Paratenic/Accidental hosts: Lungs, Eggs, Lungs

Embryonated eggs

Ingestion

Lungs

Hatch

Adult

Liver

Small intestine

Eggs

Infective larvae

CNS

Eyes

Migratory larvae

Toxocariasis

Ascarid LMS

Toxocarasis
How does someone get ascarid LMS?

Toxocara canis

Toxocara cati

Ascaris suum

Larva Migrans Syndrome
What are the symptoms of ascarid LMS?

- Many people do not have symptoms

- Some people may have:
  - Fever
  - Hypereosinophilia
  - Liver disfunction
  - Pneumonia
  - Uveitis
  - Allergic myelitis etc...

Depending on the affected organs!
How to diagnose ascarid LMS?

Detection of antibody against Toxocara and Ascaris antigens using ELISA or western blotting
Who is at risk for ascarid LMS?

Anyone!

Risk factors:

Western countries:
- Age (children)
- Dog, cat or pig owners
- Soil-related occupation

However...
Age and sex distribution of Japanese patients

(Yoshida et al., 2016)
Dietary history of ingesting raw or undercooked meat and/or liver in ascarid LMS patients

- Yes: 67.9%
- No: 32.1%

(n=480, Yoshida et al., 2016)
Who is at risk for ascarid LMS?

Anyone!

Risk factors:

Western countries:
- Age (children)
- Dog, cat or pig owners
- Soil-related occupation

Japan:
- Age (adults)
- Sex (male)
- Consumption of raw or undercooked meat and/or liver
58 year-old, male  (in 2010)

Chief complaint:
Increased WBC on a regular check-up

Presented at X University Hospital
Eo: 36%, total IgE: 2,345 U/ml

He, his 57 year-old wife, and 27 year-old son, have been ingesting raw bovine liver every week in the last 1 year. Because they believed it was good for health.
Binding of patient sera to *Toxocara canis* ES (excretory/secretory) Ag

![Graph showing optical densities at 405 nm vs. reciprocal serum dilution for Dad, Mom, and Son.](image)
### Where is the most prevalent area of ascarid LMS?

<table>
<thead>
<tr>
<th>Region</th>
<th>Total examined cases</th>
<th>Positive cases</th>
<th>Negative cases</th>
<th>Positive rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hokkaido/Tohoku</td>
<td>173</td>
<td>17</td>
<td>156</td>
<td>9.8</td>
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<tr>
<td>Kanto</td>
<td>666</td>
<td>79</td>
<td>587</td>
<td>11.9</td>
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<td>Chubu</td>
<td>378</td>
<td>47</td>
<td>331</td>
<td>12.4</td>
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<td>Kinki</td>
<td>1,027</td>
<td>276</td>
<td>751</td>
<td>26.9</td>
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<tr>
<td>Chugoku/Shikoku</td>
<td>405</td>
<td>68</td>
<td>337</td>
<td>16.8</td>
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<tr>
<td>Kyushu/Okinawa</td>
<td>2,883</td>
<td>424</td>
<td>2,459</td>
<td>14.7</td>
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</tbody>
</table>

(Yoshida et al., 2016)
What is effective treatment for ascarid LMS?

Albendazole 10-15 mg/kg for >4 weeks

- Steroid pulse (optional)

<table>
<thead>
<tr>
<th>ALB</th>
<th>Interval</th>
<th>ALB</th>
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<tr>
<td>4 weeks</td>
<td>2 weeks</td>
<td>4 weeks</td>
</tr>
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</table>

(Hombu et al., 2018)
How risky are raw beef and chicken?

◆ Serum samples

- **Japanese black cattle**
  - Slaughterhouse
    - A: 153 samples
    - B: 179 samples
  - 332 samples

- **Free-range chicken**
  - 178 samples from 9 farms

- **Broiler chicken**
  - 150 samples
Diagnose system for detection of ascarid infection

Screening test for anti-ascarid Abs

- *Ascaris suum*-SWAP* (As-SWAP) ELISA
  *Soluble Worm Antigen Preparations
  ➢ Positive

Discrimination of infecting species

- Pre-adsorbed larval-Excretory/Secretory (ES) Ag ELISA
  • Adsorption Ag: *Toxocara vitulorum*-SWAP • *Ascaridia galli*-SWAP
  • Detection Ag: *Toxocara canis* larval-ES antigen (Tc-ES)
    *Ascaris suum* larval-ES antigen (As-ES)

- Tc-ES>As-ES
- As-ES>Tc-ES

➢ Tc-ES Western Blot test

- *Toxocara spp.*
- *Ascaris suum*
Detection of anti-\textit{Toxocara}/\textit{Ascaris} antibodies in beef cattle

<table>
<thead>
<tr>
<th></th>
<th>\textit{Toxocara spp.}</th>
<th>\textit{Ascaris suum}</th>
<th>Negative</th>
<th>Total</th>
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<tr>
<td>A</td>
<td>14</td>
<td>8</td>
<td>131</td>
<td>153</td>
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<tr>
<td>B</td>
<td>21</td>
<td>13</td>
<td>145</td>
<td>179</td>
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<tr>
<td>Total</td>
<td>35</td>
<td>21</td>
<td>276</td>
<td>332</td>
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</tbody>
</table>

(%)  
\textit{Toxocara} spp.: 10.5%  
\textit{Ascaris} suum: 6.3%  
Negative: 83.1%  
Total: 100%

anti-ascarid Ab (+): 16.8%
Detection of anti-*Toxocara/Ascaris* antibodies in chickens

<table>
<thead>
<tr>
<th></th>
<th><em>Toxocara</em> spp.</th>
<th><em>Ascaris suum</em></th>
<th>Negative</th>
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<td>6</td>
<td>0</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21 (12%)</strong></td>
<td><strong>1 (0.6%)</strong></td>
<td><strong>156 (87.6%)</strong></td>
<td><strong>178</strong></td>
</tr>
</tbody>
</table>

anti-ascarid Ab (+): 12.6%
How to prevent ascarid infections in domestic animals?

- Keep dogs and cats out of the barn
- Keep animals separately
- Deworm dogs, cats and pigs
- Do not feed the feedstuff potentially contaminated with ascarid eggs or larvae

Give the information about the infection to farmers!
How to prevent ascarid LMS in humans?

- Deworm dogs, cats and pigs
- Reduce contact with contaminated soil
- Wash hands after taking care of animals and working with soil
- Wash vegetables before eating

Avoid consumption of raw meat and liver!
Acknowledgement

University of Miyazaki

Laboratory of Veterinary Parasitic Diseases, Department of Veterinary Sciences

Nariaki Nonaka  Yen TH Nguyen  Yayoi Hayata
Syun Tanaka  Shino Sonoda

Division of Parasitology, Department of Infectious Diseases, Faculty of Medicine

Haruhiko Maruyama  Amy Hombu  Mika Kuroki
Zhenzhen Wang  Miho Shibata

Center for Animal Disease Control (CADIC)

Naoaki Misawa  Ryoko Uemura

Meat Inspection Offices, Miyazaki prefecture