Epidemiology, diagnosis and control of *Opisthorchis felineus* in Europe

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Epidemiology

- There species have been identified in the Opisthorchidae family
  - *Opisthorchis felineus*
  - *Opisthorchis viverrini*
  - *Clonorchis sinensis*

- Worldwide, the prevalence of human infection has been estimated (WHO, 1995) to be:
  - 1.2 million with *O. felineus*
  - 9 million with *O. viverrini*
  - 7 million with *C. sinensis*
Opisthorchis felineus

- It is a trematode, a liver fluke
- It was described by Rivolta in 1884
- It has been detected in Asia and Europe
- To complete its natural cycle, *O. felineus* needs:
  - a definitive fish-eating mammalian host
  - a freshwater snail as first intermediate host
  - a cyprinid fish as second intermediate host

![Diagram of the life cycle of Opisthorchis felineus](image-url)

- Egg
- Miracidium
- Sporocyst
- Redia
- Cercaria
- Metacercaria
- One month in mammals
- 2 months in snails
- 3 weeks in fish
- 2 months in fish
**O. felineus** biology and morphology - 1

- It is a hermaphroditic trematode
- The adult worm is dorsoventrally flatted and with two suckers (oral and ventral)
- It can be distinguished from the other species of the family Opisthorchidae by morphology
- The size of *O. felineus* adult worm is 7-12x2-3 mm; the worm size is under the influence of the bile duct diameter and intensity of infection
- The eggs measure 25-35x15-17µm
O. felineus adult morphology
O. felineus adult morphology
O. felineus biology and morphology - 2

- The first intermediate hosts are freshwater snails of the genus *Bithynia* (e.g., *B. inflata*, *B. tentaculata*, *B. leachi*) living in lakes or in slow-flowing streams.

- In snails, two larval stages can be detected: sporocyst and redia.

- The prevalence of infection in snails is generally in the range of 0.07-0.63%.
O. felineus biology and morphology - 3

- The second intermediate hosts are freshwater fish of the family Cyprinidae (e.g. golden orfe, *Leuciscus idus*; common dace, *L. leuciscus*; common roach, *Rutilus rutilus*; tench, *Tinca tinca*; barbel, *Barbus barbus*; carp bream, *Abramis brama*)
- In fish, only the larval stage, metacercaria, can be detected
- A fish can host from one up to 30,000 metacercariae
- More than 6,000 metacercariae have been detected per gram
# Detection of *O. felineus* in EU countries up to 1962*

<table>
<thead>
<tr>
<th>Country</th>
<th>Locality</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Wien</td>
<td>Cat</td>
</tr>
<tr>
<td>France</td>
<td>Paris, Grandson</td>
<td>Cat, fox</td>
</tr>
<tr>
<td>Germany</td>
<td>Berlin, Hamburg</td>
<td>Cat, fox, fish</td>
</tr>
<tr>
<td>Greece</td>
<td>Kastoria, Macedonia</td>
<td>Man, cat, dog</td>
</tr>
<tr>
<td>Hungary</td>
<td>Budapest</td>
<td>Cat</td>
</tr>
<tr>
<td>Italy</td>
<td>Rome, Pisa, Milan, Brescia, Modena</td>
<td>Cat, dog, rabbit</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Kaunas</td>
<td>Cat</td>
</tr>
<tr>
<td>Netherland</td>
<td>Utrecht, Gouda, Westbrock</td>
<td>Cat, dog, fish</td>
</tr>
<tr>
<td>Poland</td>
<td>Warsaw, Danzig, Narmeln</td>
<td>Cat, fish, man</td>
</tr>
<tr>
<td>Romania</td>
<td>Samova, Danube</td>
<td>Fish, cat</td>
</tr>
<tr>
<td>Spain</td>
<td>Bilbao, Cordoba</td>
<td>Fish, man</td>
</tr>
</tbody>
</table>

*data from Erhardt et al. 1962*
Detection of *O. felineus* in EU countries from 1991 to 2003

<table>
<thead>
<tr>
<th>Country</th>
<th>Region</th>
<th>Host</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Mecklenburg-Pommerania</td>
<td>Man</td>
<td>Sänger et al., 1991</td>
</tr>
<tr>
<td></td>
<td>Brandenburg</td>
<td>Cat, 6 fish species, 2 snails</td>
<td>Hering-Hagenbeck and Schuster, 1996</td>
</tr>
<tr>
<td></td>
<td>Brandenburg</td>
<td>Cat (16%)</td>
<td>Schuster et al., 1997</td>
</tr>
<tr>
<td></td>
<td>Brandenburg</td>
<td>Fox (6.7%)</td>
<td>Schuster et al., 1999</td>
</tr>
<tr>
<td></td>
<td>Berlin</td>
<td>Fox (30.6%)*</td>
<td>Schuster et al., 2003</td>
</tr>
<tr>
<td>Greece</td>
<td>Athens</td>
<td>Man</td>
<td>Vassalou et al., 2000</td>
</tr>
<tr>
<td></td>
<td>unknown</td>
<td>Man</td>
<td>Tselepatiotis et al., 2003</td>
</tr>
</tbody>
</table>

*sero-prevalence
**O. felineus** human outbreaks in Italy

<table>
<thead>
<tr>
<th>Year</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of fish consumption</td>
<td>restaurant</td>
<td>restaurant</td>
<td>private dinner</td>
<td>restaurant</td>
<td>home dinner</td>
</tr>
<tr>
<td>Consumed fish</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
<td>tench</td>
</tr>
<tr>
<td>Fish origin</td>
<td>Trasimeno lake</td>
<td>Trasimeno lake</td>
<td>Bolsena lake</td>
<td>Bolsena lake</td>
<td>Bolsena lake</td>
</tr>
<tr>
<td>No. of cases</td>
<td>2</td>
<td>8</td>
<td>20</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>No. of hospitalised persons</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Symptomatic/ asymptomatic</td>
<td>1/1</td>
<td>0/8</td>
<td>11/9</td>
<td>1/1</td>
<td>1/1</td>
</tr>
<tr>
<td>Treatment</td>
<td>no</td>
<td>no</td>
<td>20</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
O. felineus metacercariae in freshwater fish and cats of Central Italy lakes

<table>
<thead>
<tr>
<th>Lakes</th>
<th>Trasimeno</th>
<th>Bolsena</th>
<th>Vico</th>
<th>Bracciano</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tench (Tinca tinca)</td>
<td>43%</td>
<td>74%</td>
<td>28%</td>
<td>95%</td>
</tr>
<tr>
<td>Stray cats</td>
<td>40%</td>
<td>26%</td>
<td>-</td>
<td>38%</td>
</tr>
</tbody>
</table>

Fifteen fish species (800 specimens) tested for metacercariae but negative: Anguilla anguilla, Atherina boyeri, Barbus plebejus, Carassius carassius, Chondrostoma genei, Coregonus sp., Cyprinus carpius, Esox lucius, Ictalurus melas, Lepomis gibbosus, Leuciscus cephalus, Micropterus salmoides, Mugil cephalus, Perca fluviatilis and Scardinius erythrophthalmus
Detection of *O. felineus* metacercariae in fish

- by muscle compression (trichinoscopy)
- by digestion (the same protocol as for *Trichinella*)
- the metacercariae burden is higher in the muscle of the caudal and dorsal paddle
- metacercariae can be identified at the family or species level by:
  - Morphology
  - PCR derived methods
Detection of *O. felineus* infection in final mammalian hosts

- **Parasitological detection**
  - detection of parasite eggs in faecal samples
  - the eggs measure 25-35 x 15-17 µm
    (e.g., a *Giardia* cyst measures 11-14 x 7-10 µm)

- **Serological detection**
  - ELISA tests have been developed for humans and carnivores (foxes, cats) using excretory/secretory antigens from adult worms in vitro

- **Molecular detection**
  - By PCR of faecal samples
Detection of *O. felineus* infection in snails

- The larval stages (sporocyst or redia) present in snails can be detected by:
  - microscope dissection of the snail
  - PCR analysis of homogenised snail body
Alignment of the ITS2 region of the rDNA of *O. felineus*
Clinical and laboratory features of *O. felineus* infection in humans

- **Signs and symptoms:**
  - fever, nausea, abdominal pain, myalgia and diarrhea
  - incubation period about two weeks
  - in chronic infections, cholangitis and obstructive jaundice have been documented as well as cholangiocarcinoma

- **Laboratory features:**
  - leukocyte count up to $29.8 \times 10^3/\mu\text{L}$
  - eosinophilia up to 65%
  - liver enzymes (AST/ALT mU/mL) up to 315/899
Treatment of *O. felineus* infection in humans

- **First choice**
  - Praziquantel, 25 mg/kg *per os* tid, for 1 day

- **Second choice**
  - Albendazole, 10 mg/kg daily *per os*, in 2 doses for 7 days
Prevention of *O. felineus* infection in humans and pets

- metacercariae may be killed by:
  - cooking at 70°C in the core of the fish product for 1 min
  - freezing at -10°C in the core of the fish product for 5-70 days (depending on the fish size)
  - freezing at -28°C in the core for 24 hours
  - consuming raw fish frozen in a home freezer could be at high risk
  - by irradiation at 0.15 kGy

- fishermen, restaurant owners, etc. should avoid to spread uncooked fish in the environment or in not controlled garbage
Tank you for your attention