Hepatitis E in Pigs:
A foodborne threat or a threat to food?

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• Hepatitis E virus – an emerging viral zoonosis

• Increasing awareness of HEV in pigs

• Epidemiological links between consumption of HEV-contaminated pigmeat and HEV infection in humans

• Is there a threat to Irish consumer health from HEV in pigmeat?

• Is there a threat to the Irish pig industry from consumer concerns about HEV?
Hepatitis E virus

- Non-enveloped, +ve sense, single strand RNA virus
- Faecal-oral transmission
- Causes hepatitis in humans; can be severe in immunocompromised individuals and pregnant women

Four genotypes
- **Gt 1 and 2**: Affect **humans**, developing countries, waterborne epidemics
- **Gt 3 and 4**: Affect **humans and animals**, main causes of human HEV in developed countries
  - Gt3: mainly found in Europe, America, Asia
  - Gt4: mainly China & Japan
Possible transmission by blood transfusion???
What is the evidence for HEV in European pigs?

**Germany:** 49.8% seroprevalence (on farm) (Bachlein et al, 2010)

**Netherlands:** 70% seroprevalence (at slaughter), 50% RNA +ve on farm (Rutjes et al, 2014)

**Scotland:** 61% seroprevalence (at slaughter) (Crossan et al, 2014)

**Switzerland:** 58% seroprevalence (at slaughter) (Burri et al, 2014)

**Finland:** Two known positive farms examined: 87.5% of piglets shed HEV gt3 (Kantala et al, 2015)

**Slovakia:** 26% of pigs RNA +ve (on farm) (Jackova et al, 2014)

**France:** 65% of pig farms positive, 4% of pig livers RNA positive (Pavio et al, 2014)

**Denmark:** 92% of sow herds & 73% of pigs seropositive on farm; 55% of sow herds & 49% of pigs were HEV RNA positive on farm (Breum et al, 2010)
Also found in wild boar...

- HEV found in wild boar in several European countries

- Hunters often make home-made or artisan wild boar meat products

- No wild boars in Ireland – although meat can be imported...
What is the evidence for food-borne transmission of HEV?

- **France**: infection due to raw pork liver sausages (figatelli); affected patient had HEV genotype 3f
  Leftover sausages had been frozen: HEV +ve, **100% sequence identity** at ORF 1 and 2 regions (Renou et al, 2014).
  HEV RNA detected in pigmeat products (68/394) (Pavio et al, 2014)

- **Japan**: HEV infection following ingestion of wild boar and venison - HEV isolated from patients and leftover meat were sequenced (ORF2) region -> **identical** (Li et al, 2005)

- **UK**: HEV detected in pig liver at slaughter (1/40) and in pork sausages at retail point (6/63) (Berto et al, 2012)
  Pig serum collected at slaughter – **37/640 RNA positive**; six of the positives were sequenced – genotype G3 group 1; but **65% of human UK Gt3 infections caused by group 2** (Advisory Cttee on Micro Safety of Food, 2015)
HEV in pigs: epidemiology

- Maternal antibodies protect for first few weeks
- Viraemia appears at 9 weeks, peaks at 15 weeks

Comparison of “infection escape time” between piglets with/without maternal antibodies:
With: 8.7–13.8 weeks
Without: 2.7 – 7.6 weeks
(Andraud et al, 2014)

-> so do maternal Abs reduce or increase the risk of viraemia at slaughter???

HEV in pigs: pathology

• Clinical signs not reported (function of intensive pig farming?)

• Histologically, mild to moderate lymphocytic hepatitis reported

Liver from natural infected piglets showing multifocal lymphohistiocytic infiltrates irregularly distributed in the liver and cluster of mononuclear inflammatory cells in portal tract

HEV in Irish Pigs

- **Sera from 330 Irish breeding pigs** (sows & boars) sampled in 2010/11 as part of a surveillance scheme
- 16 herds in nine counties, 5-60 samples/herd (median=15/herd)
- Tested using commercial ELISA (Prionics) for pig HEV antibodies
- **27% pigs** (89/330) positive
- **81% herds** (13/16) had at least one positive sample

-> First evidence that HEV is present in the Irish pig population

O’Connor et al, Irish Vet J, 2015
Prevalence in Irish fattener pigs at slaughter: preliminary data

Survey:
Six fatteners per herd sampled at slaughter, tested for HEV antibodies, **136 herds, n=814 pigs total**

Results:
**Pigs:** 489 (60.1%) positive; 80 doubtful, 245 negative (30.1%)

**Herds:** 128 (94.1%) had at least one positive sample
Number of herds

Frequency of positives per herd

Number of positive samples, n=6 samples per herd
Detecting HEV RNA in Irish pigs: preliminary data

• 210 faecal samples collected at slaughter: 209 negative, one weak positive

• Routine testing of piglets submitted for post-mortem examination: several positives (ongoing process)

Consistent with a hypothesis that many pigs are commonly infected with HEV as weaners then develop antibodies and clear the virus by the time they reach slaughter age?
Significant questions remain

- **How many pigs** from an infected farm are *viraemic at slaughter*?
- What is the *epidemiology* of HEV in Irish pig farms?
- How do **Irish farming systems** influence exposure, transmission and immunity in terms of HEV? Is the pattern similar to that found in Spain?
- Do **Irish pigmeat products** derived from viraemic pigs contain HEV?
- *Are Irish pig HEV isolates the same genotypes/subtypes as those found in Irish consumers?*

-> Is there a risk of HEV transmission to consumers?
Potential threat to consumer confidence

• Pigmeat products consumed in Ireland may come from a range of countries
• May include fermented products (sausages, salamis)
• Some pigmeat products made here may be a mix of Irish and non-Irish origin pigmeat

-> If Irish consumers became infected with HEV through consuming pigmeat products, we should not assume it was necessarily due to consumption of Irish pigmeat

-> Other routes of transmission – could Irish pigmeat similarly be incorrectly linked to cases it had not caused?
Further issues...

• What is the infectious dose for humans?

• How long and at what temperature must a pigmeat product be cooked to eliminate the risk of HEV?

• What other sources of HEV pose risks to the Irish public?
Benefits of further research

If there is a risk to consumers posed by HEV in Irish pigs – further research could help to identify ways to mitigate that risk

If HEV infections are caused in Irish consumers by pigmeat products of non-Irish origin, further research could help to protect the reputation of the Irish pig sector
A One Health approach is needed
Any questions?

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