

Egg Production and Egg Quality Problems

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Egg Production and Egg Quality

- Breeders companies give guidelines regarding sexual maturity (17 to 18 weeks), peak of lay (90 % at 32 weeks), end of production at 80 weeks of age for one cycle. Second laying cycles at 105 weeks of age
- Management: ventilation, lighting, feeding, nutrition especially protein, Ca and P, water quality, litter quality, cages, rodent and fly control, dead bird disposal, manure disposal

Egg Production and Egg Quality

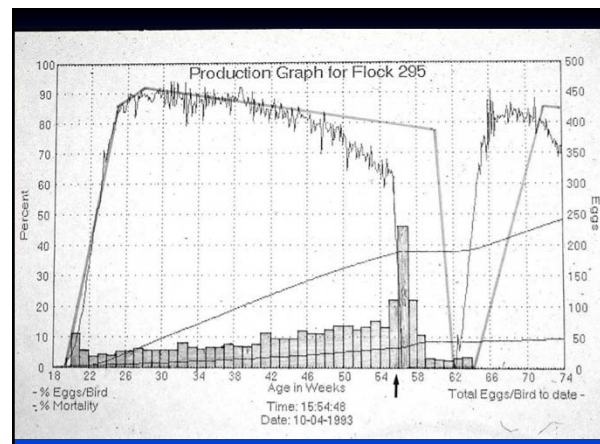
- Biosecurity
- Cleaning and disinfection
- Vaccinations: depends on the region and disease problems. Types and dose of vaccines, routes of vaccination, *etc.*
- Standard vaccination program: MDV, IBDV, IBV, NDV, ILT, Pox, AE, CAV, *S. Enteritidis*
- Flock: Antibiotic free, organic?

Causes of Egg Production and/or Egg Quality Problems - Infectious

- Viruses: IBV, NDV, AE, EDS 76, AI, ILT, APMV-3, APMV-2, Pox, MDV/LL/REV, Hepatitis E virus, *etc.*
- Bacteria, MG, MS, Salmonella (SE and others), Infectious coryza, *P. multocida*, ORT, *E. coli*, Spirochetes, *etc.*
- Histomonas, coccidia, round worms, mites, *etc.*

Causes of Egg Production and Egg Quality Problems – Non infectious

- Nutrition: lack of Ca, P, vitamin D3, Ca:P ratio, water, essential amino acids, vitamins, *etc.*
- Toxicosis: mycotoxins (T2, Aflatoxins, Ochratoxins), ammonia, minerals, Nicarbazin, Iodine, vitamins, *etc.*
- Light, temperature, vaccines, stray voltage, *etc.*





Avian Hepatitis E virus Infection in Chickens

Hepatitis E virus Infection

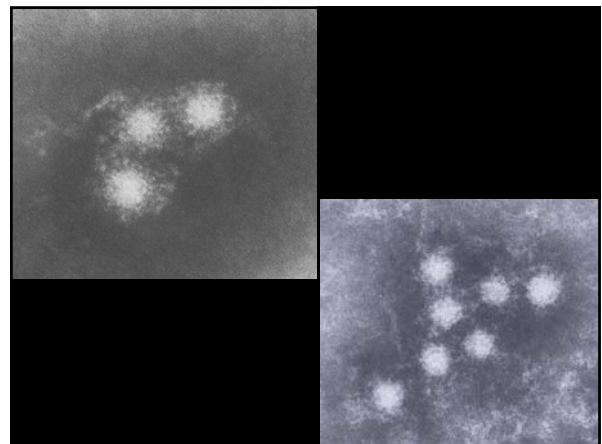
- ❑ Has been called by various names
- ✓ Hepatitis splenomegaly syndrome
 - Weeping liver disease
 - Necrotic Hemorrhagic Hepatitis-splenomegaly syndrome
 - Chronic Fulminating Cholangiohepatitis
 - Hepatitis-Liver Hemorrhage Syndrome
 - Necrotic haemorrhagic hepatomegalic hepatitis
 - Necrohemorrhagic hepatitis
- ❖ Big liver and spleen disease - Australia

Hepatitis-Splenomegaly syndrome



Hepatitis-Splenomegaly syndrome

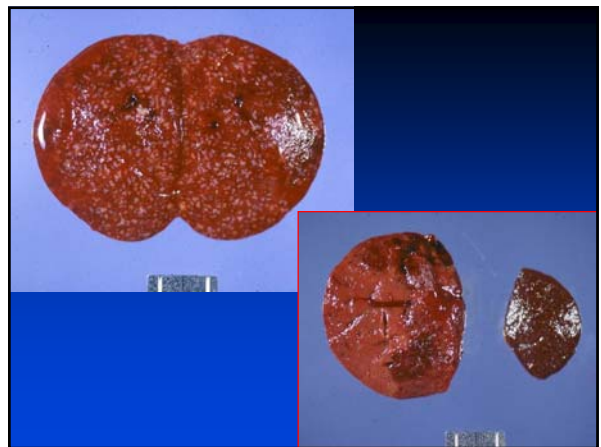
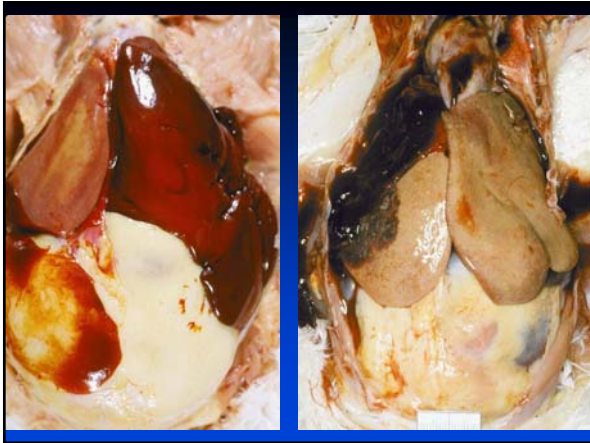
- 1993 – from California (Dr. Read *et al.*)
 - incidence over eight years on two farms
 - in 40–60 week-old White Leghorns
 - increased mortality (0.1 – 0.3 % / week)
 - decreased egg production (12 – 20 %)
 - Bile: 30–40 nm virus particles by EM
 - influence of force-molt
- ❖ 1995 – Shivaprasad and Woolcock
 - ✓ 52–56 week-old broiler breeders, decreased egg production and increased mortality



Hepatitis-Splenomegaly syndrome

❖ Gross Pathology

- sudden death, pale combs
- clotted blood or red watery fluid in abdominal cavity
- Liver pale, enlarged, friable, mottled tan/red, subcapsular hemorrhages or hematomas, ruptures, clotted blood
- Spleen, enlarged and pale
- regressing ovary and oviduct



Hepatitis-Splenomegaly syndrome

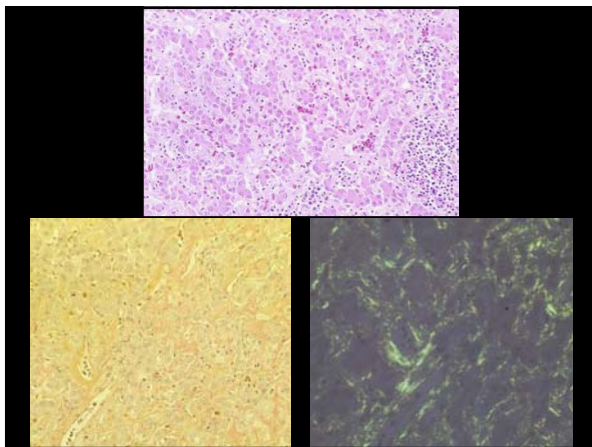
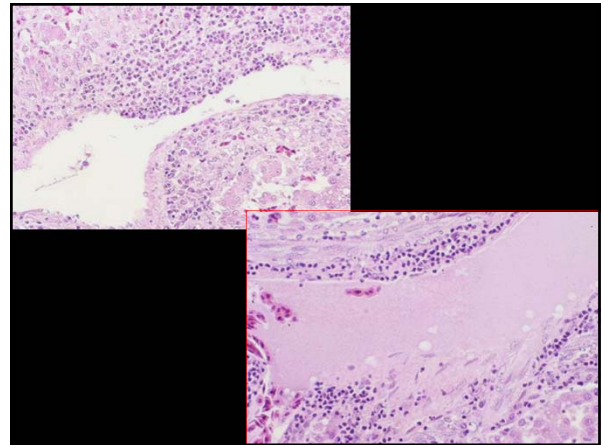
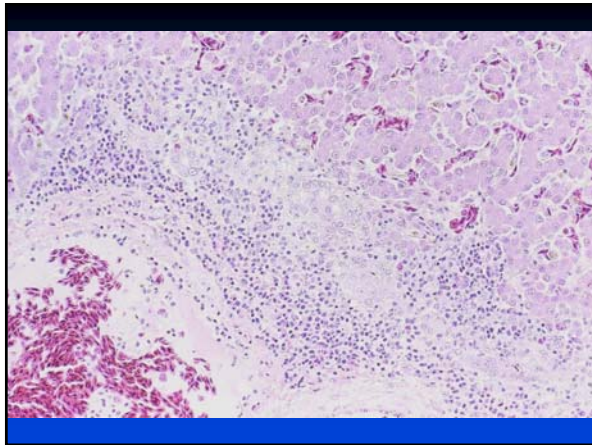
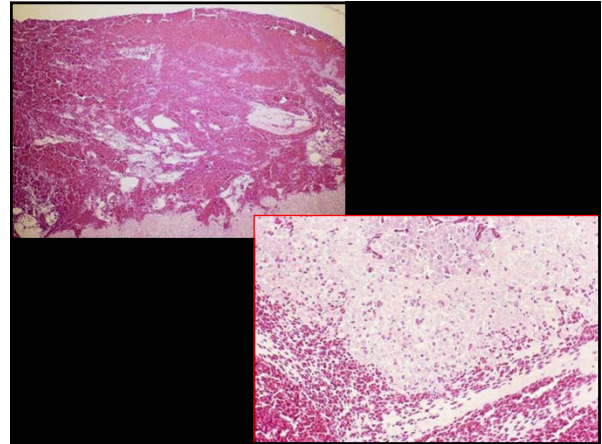
▪ Histopathology

Liver: periportal and vascular inflammation (phlebitis)

- amyloid in the interstitium and vessels
- necrosis, hemorrhage, fibrin exudation
- granulomas, biliary hyperplasia

Spleen: lymphoid depletion, increase in Mononuclear Phagocyte System cells

- amyloid in vessels and interstitium



Hepatitis E virus in humans

- Causative agent of Hepatitis E
 - 20 % mortality in pregnant women
- SS RNA virus with out an envelope
- 30 – 35 nm in diameter
- been isolated from swine and rodents
- serological evidence in other mammals

Big Liver and Spleen Disease

- Recognized in Australia in 1980's
- Disease of broiler breeders and less commonly laying-type chickens
 - decreased egg production and increased mortality
 - enlarged liver with subcapsular hemorrhages, enlarged pale spleen
 - lymphocytic hepatitis and splenitis
 - evidence of virus in UK and US by serology
- ☐ Virus isolated by IV inoculation of chicken egg embryos

Big Liver and Spleen Disease

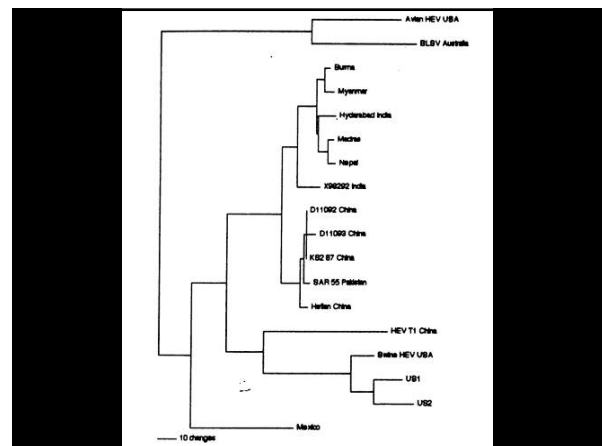
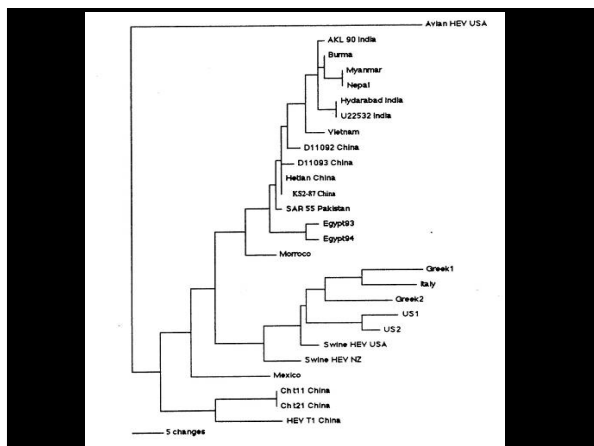
- ✓ Virus isolation in chick embryos, I/V route
- ✓ High titer of virus in liver of chicks
- ✓ Monoclonal ab to 16 kDa protein, sequence of genome fragments, Degenerate primer, RT-PCR
- ✓ Nucleotide sequence – hepatitis E virus
- ✓ BLSDV - 62 % sequence identity with helicase gene of human hepatitis E virus

Hepatitis-Splenomegaly Syndrome

- ☐ Drs. Haqshenas, Shivaprasad and Meng
 - bile inoculated in to chick embryos by I/V
 - harvested liver from hatched chicks
 - sequencing, RT-PCR, *etc.*, in 2001
 - genomic organization and sequence homology elated to hepatitis E virus
- Serological survey in US by Huang *et al.* in 2002 – 71 % flocks positive.
- Billum *et al.* reproduced the disease in chickens in 2009

Hepatitis-Splenomegaly Syndrome

- Part of HSS viral genome sequenced, compared with human HEV
 - 46-48 % identity with RdRp gene
 - 58-61 % identity with helicase gene
 - 44-46 % identity with ORF2 gene
- HSS virus, 80 % identity with BLSDV (helicase gene)
- HSS virus – most divergent Hepatitis E virus identified so far, named Avian HEV



Hepatitis-Splenomegaly syndrome

- Disease is widespread; Many countries in Europe, China, Korea
- Hepatitis E virus is also present in healthy chickens
- HSS virus: four genotypes recognized
 - ✓ Genotype 1 - Australia and Korea
 - ✓ Genotype 2 - USA and Spain
 - ✓ Genotype 3 - Europe and China
 - ✓ Genotype 4 - Taiwan and Hungary
- ☐ Great genetic diversity exists

Hepatitis E virus infection - Summary

- ✓ Hepatitis-splenomegaly syndrome and Big liver and spleen disease
- ✓ Causes clinical signs of decreased egg production and increased mortality
- ✓ Gross and histopathology
- ✓ Most divergent virus compared to mammalian virus
- ✓ Model to study hepatitis E virus infections

