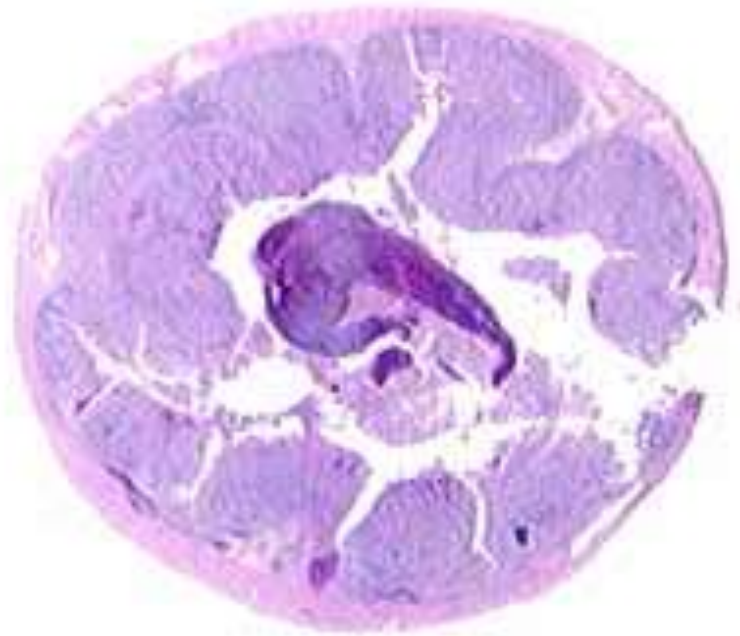


Overview of Coccidiosis in Poultry



Plan Of Talk

- Introduction
- Etiology
- Coccidia life cycle
- Transmission
- Pathogenicity
- Clinical signs
- Diagnosis
- Control
 - Management
 - Vaccination

Plan Of Talk

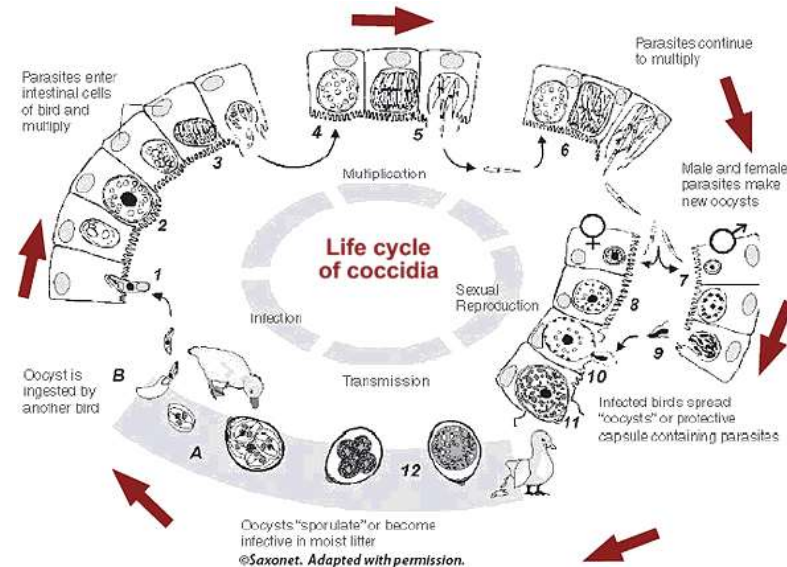
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What Is Coccidia?

- Coccidiosis is a parasitic disease that can cause severe losses in poultry, whether in meat and egg production.
- Coccidia is distributed worldwide in poultry, game birds reared in captivity and wild birds.
- Coccidiosis is caused by protozoa of the phylum Apicomplexa, family Eimeriidae.
 - In poultry, most species belong to the genus *Eimeria*.

Cont. ...

- Coccidia infects various sites in the intestine.
- The infectious process is rapid (coccidia life cycle lasts from 4–7 days) and is characterized by parasite replication in host cells with extensive damage to the intestinal mucosa.



Coccidia ... Host Damage

The parasites multiply in the intestines and cause:

1. Tissue damage.
2. Lowered feed intake.
3. Poor absorption of nutrients.
4. Dehydration.
5. Blood loss.

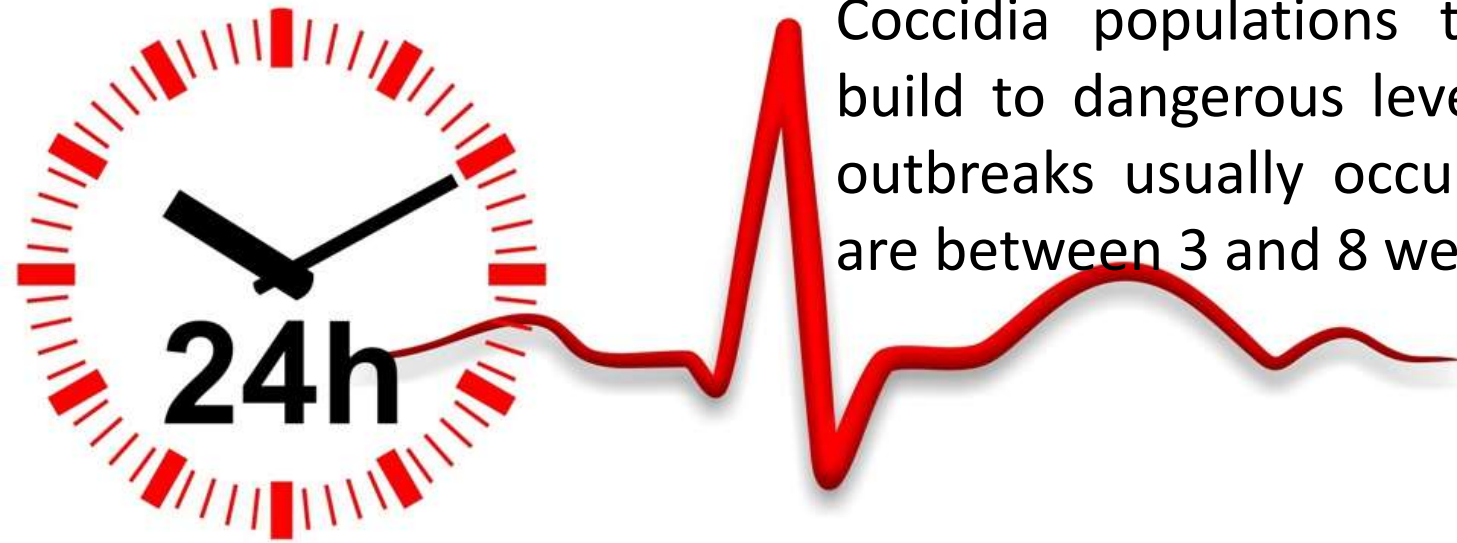


Coccidia Incidence

Coccidiosis is usually a disease of young birds, but birds can be infected at any time if never been exposed before.



Cont. ...



Coccidia populations take time to build to dangerous levels, therefore outbreaks usually occur when birds are between 3 and 8 weeks of age.

Coccidia ... Does Not Come Alone

Coccidiosis goes hand-in-hand with other gut diseases, because it damages the gut mucosa and allows bacteria to enter causing secondary infections.



Coccidia ... Host and Site Specificity

Poultry coccidia are generally:

- **Host specific**, every parasite infects a specific animal specie.
- **Site specific**, every parasite infects a specific site of the intestine.

Coccidia ... Complications

If an outbreak of coccidiosis left untreated;

1. The infection eventually runs its course and subsides.
2. Most of the flock will survive.
3. Recovered birds will gain immunity.
4. Production losses would never be recovered or compensated.
5. In severe infections, the gut remains scarred and impaired, and stunted broilers do not catch up in weight gain.
6. Birds are subjected to secondary bacterial infections especially clostridia.

Coccidia and Production System

Chicks reared in cages would be less susceptible to infection and vice versa for chicks reared on litter.



Coccidia and Production Density

- Low-density production systems;
 - Allow a low level of exposure.
 - Allow immunity development without making the birds sick and damaging performance.
 - Birds are then protected.
- However, as the size of flocks increase, the numbers of coccidia also grow and can pose a threat to the flock.

Cont. ...

- In low-density production or with the use of preventative medication, coccidiosis generally remains a subclinical disease that only affects performance, without the alarming losses.



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Etiology

- Coccidia are almost universally present in poultry raising operations
- Clinical disease occurs only after ingestion of relatively large numbers of **sporulated oocysts**.
- Both clinically infected and recovered birds shed oocysts in their droppings, which contaminate feed, dust, water, litter, and soil.

Cont. ...

Specie-Specific Parasites

- Almost all livestock are affected by different types of coccidia.
- Each type of coccidia infects only one specie of livestock, each is “specie-specific.”
- Immunity to one type does not provide immunity for other types.

Cont. ...

There are seven different Eimeria species that infect chickens;

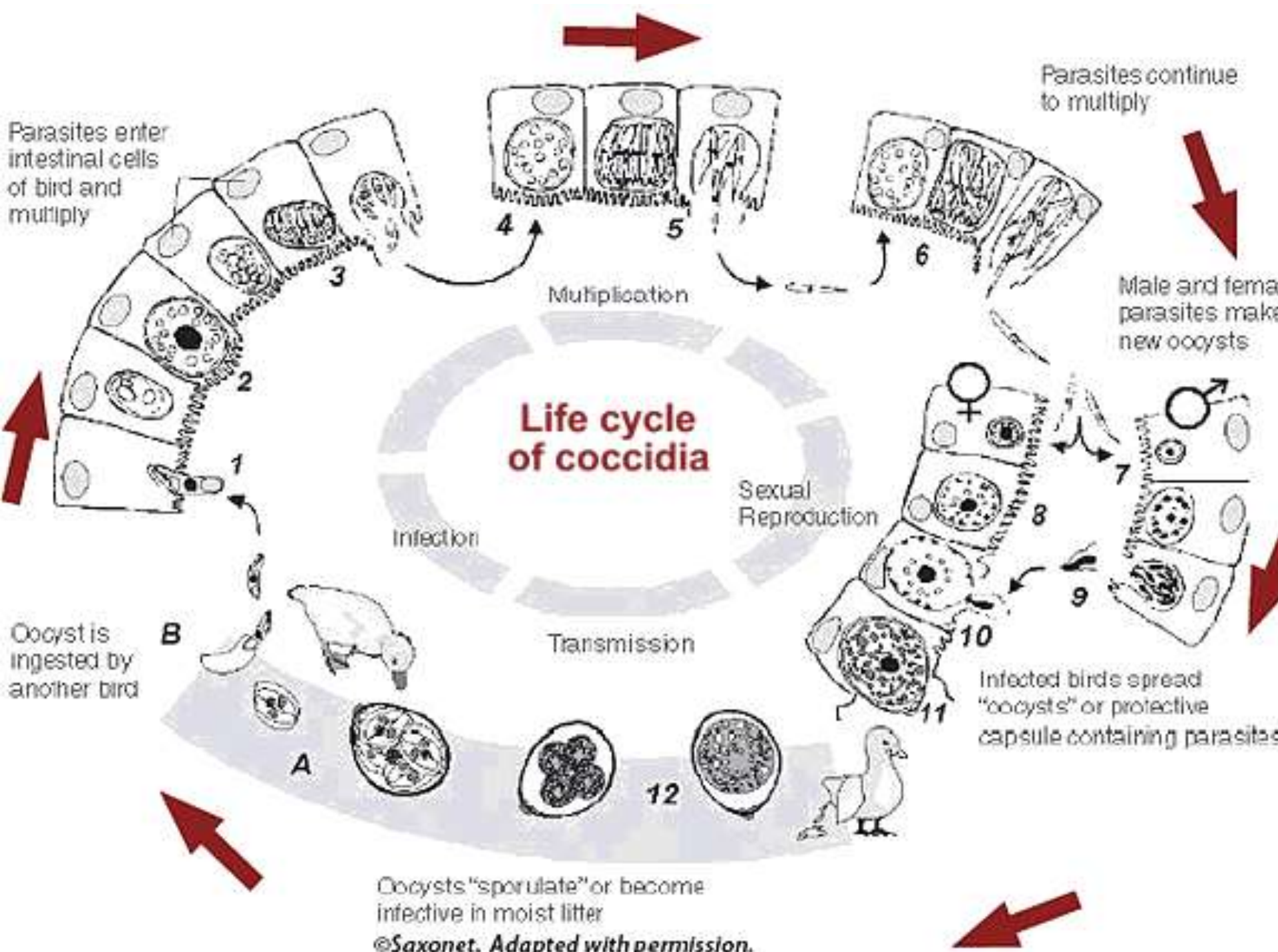
1. *Eimeria acervulina*
2. *Eimeria maxima*
3. *Eimeria tenella*
4. *Eimeria necatrix*
5. *Eimeria mitis*
6. *Eimeria brunetti*
7. *Eimeria praecox*

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Coccidia Life Cycle

- Coccidiosis is caused in poultry by a parasite of the genus *Eimeria*.
- The life cycle of *Eimeria* takes about 4 - 7 days to complete.



1

- It begins when “oocysts” are present on the litter
 - An “oocyst” is a capsule with a thick wall protecting the parasites.

2

- When moisture, temperature, and oxygen become conducive to growth, and within 2 days, they become sporulated oocyst and become infective.

3

- After a bird eats the sporulated oocysts, coccidia imbed in the intestinal lining and multiply several times, damaging tissue.
- Coccidia are parasites, so they get their nutrients from the chicken host.
- The multiplications eventually stop, usually before causing death of the bird.

4

- The bird sheds the oocysts in its droppings.

Coccidial Multiplication

- Coccidia are very prolific parasites.
 - A single sporulated oocyst can have a big impact when eaten by a chicken.
- Each oocyst contains 4 sporocysts.
- Each sporocyst contains 2 sporozoites.

Cont. ...

Asexual multiplication

- 8 sporozoites are released from one oocyst, then they move to invade other cells lining of the digestive tract and continue multiplication.
- There may be several generations of asexual multiplication; however, this stage is self-limiting and eventually stops.

Sexual multiplication

- The sexual stage occurs in which male and female organisms unite and form new oocysts that are protected by a thick wall.
- These oocysts are shed in the feces.

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Mode of Transmission

- Infected chickens shed oocysts for several days or weeks.
- Oocysts may be transmitted by mechanical carriers (eg, equipment, clothing, insects, farm workers, and other animals).

Sporulation

- Fresh oocysts are not infective until they sporulate.
- Sporulation may take 1-2 days under optimal conditions:
 - 21°–32°C
 - Moisture at least 20% and presence of oxygen.
 - The rate of sporulation is slower if temperatures are much cooler or hotter.
- Sporulated oocysts may survive for long periods, depending on environmental factors, if protected from very hot, dry, or freezing conditions.

Cont. ...

- In very large poultry houses, oocysts do not last long in the litter because:
 1. The action of ammonia released by decomposition of litter and manure
 2. The action of molds and bacteria.

Cont. ...

- Oocysts are resistant to some disinfectants commonly used around livestock but are killed by freezing or high environmental temperatures.

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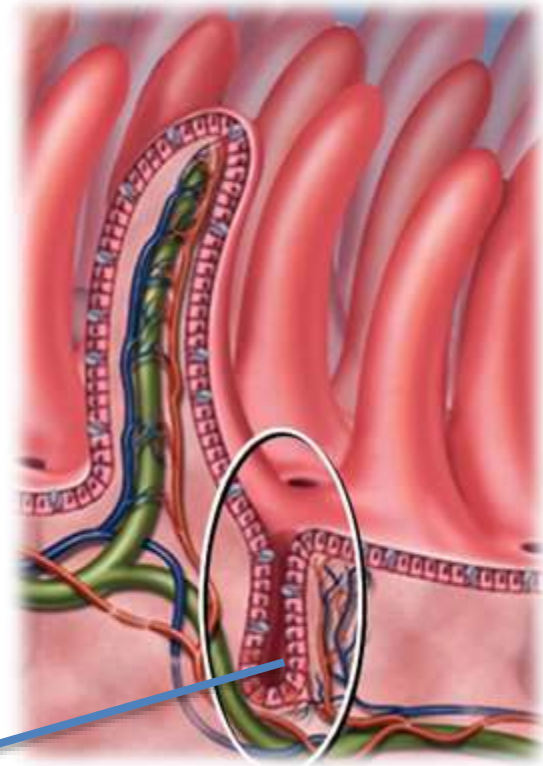
Pathogenicity

Pathogenicity is influenced by:

1. Host genetics
2. Nutritional factors
3. Concurrent diseases
4. Age of the host
5. Species of coccidia

Cont. ...

- *Eimeria necatrix* and *Eimeria tenella* are the most pathogenic in chickens, because schizogony occurs in the **lamina propria** and **crypts** of the small intestine and ceca, respectively, and causes extensive hemorrhage.
- Most species develop in **epithelial cells lining the villi.**



Intestinal crypts

Cont. ...

- Protective immunity usually develops in response to moderate and continuing infection.
- True ageimmunity does not occur.
- Older birds are usually more resistant than young birds because of earlier exposure to infection.

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Clinical Signs

1. Decreased feed and water consumption.
2. Decreased growth rate with high percentage of visibly sick birds.
3. Weight loss.
4. Severe diarrhea, bloody diarrhea.
5. Development of culls.
6. Decreased egg production.
7. High mortality.

Cont. ...

8. Mild infections (subclinical) may cause depigmentation and potentially lead to secondary infection, particularly *clostridium* spp infection.
9. Survivors of severe infections recover in 10–14 days but never recover lost performance.
10. Lesions are present along the intestinal tract and often have a distinctive location and appearance that is useful in diagnosis.



- Bloody faeces



- Bloody faeces
- Ruffled feathers



- Dehydration.
- High degree of anemia of the body and viscera.



- Anemic appearance of internal organs.



- Intestinal haemorrhages may be petchial and could be seen through the intestinal wall.




- Intestinal haemorrhages may be patchial and could be seen through the intestinal wall.

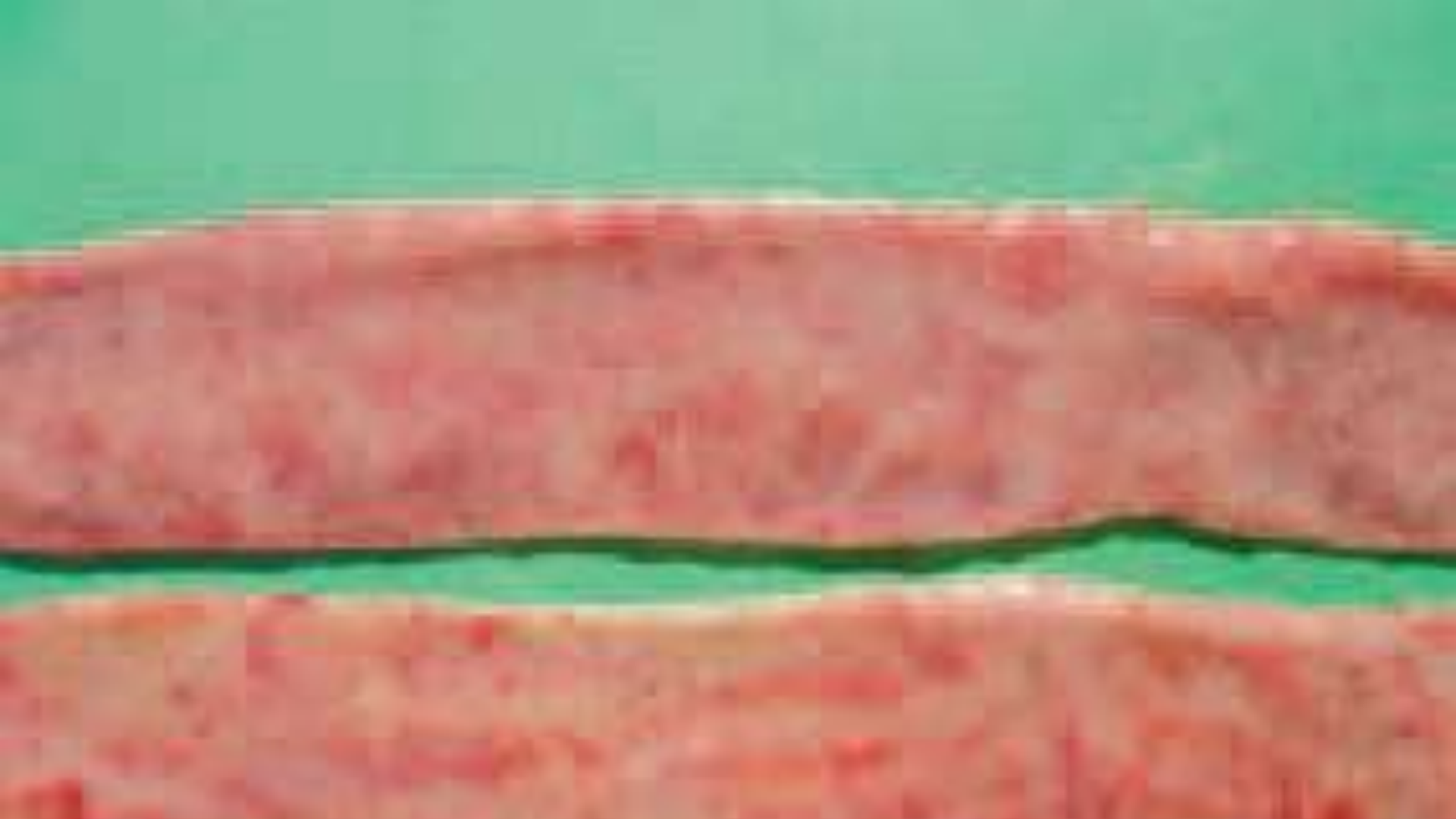


- Intestinal haemorrhages may be patchial and could be seen through the intestinal wall.



- Sometimes, a reaction of the intestinal lymphoid tissue is present.

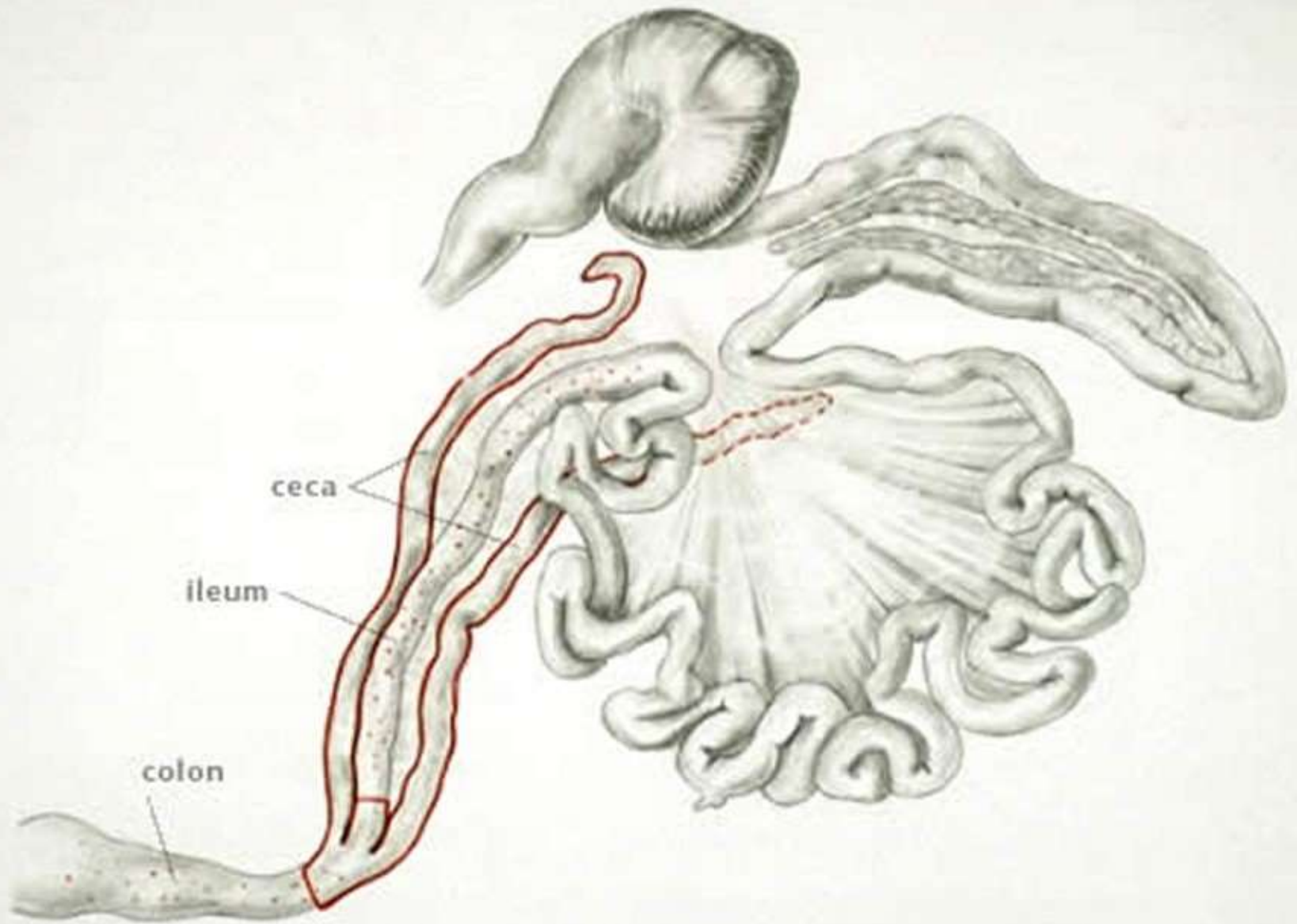
- 
- A gross pathology specimen of a gastrointestinal tract, likely a stomach or small intestine, is shown. The mucosal surface is heavily hemorrhagic, with a dark red, mottled appearance. The lumen is filled with a mixture of fresh or clotted blood and mucus. The surrounding tissue is pale and appears normal.
- The content is mixed with fresh or clotted blood, and the mucous coat is mottled with multiple petechial or larger haemorrhages.



- The content is mixed with fresh or clotted blood, and the mucous coat is mottled with multiple petechial or larger haemorrhages.

E tenella

Infections are found only in the ceca.



Coccidiosis site parasitized by *E. tenella* in poultry.

E tenella

- Characterized by:
 1. Accumulation of blood in the ceca.
 2. Bloody droppings.
 3. Cecal cores, which are accumulations of clotted blood, tissue debris, and oocysts, may be found in birds surviving the acute stage.



- Gross lesions of *E. tenella* with frank hemorrhaging into cecal pouches in a broiler chicken.



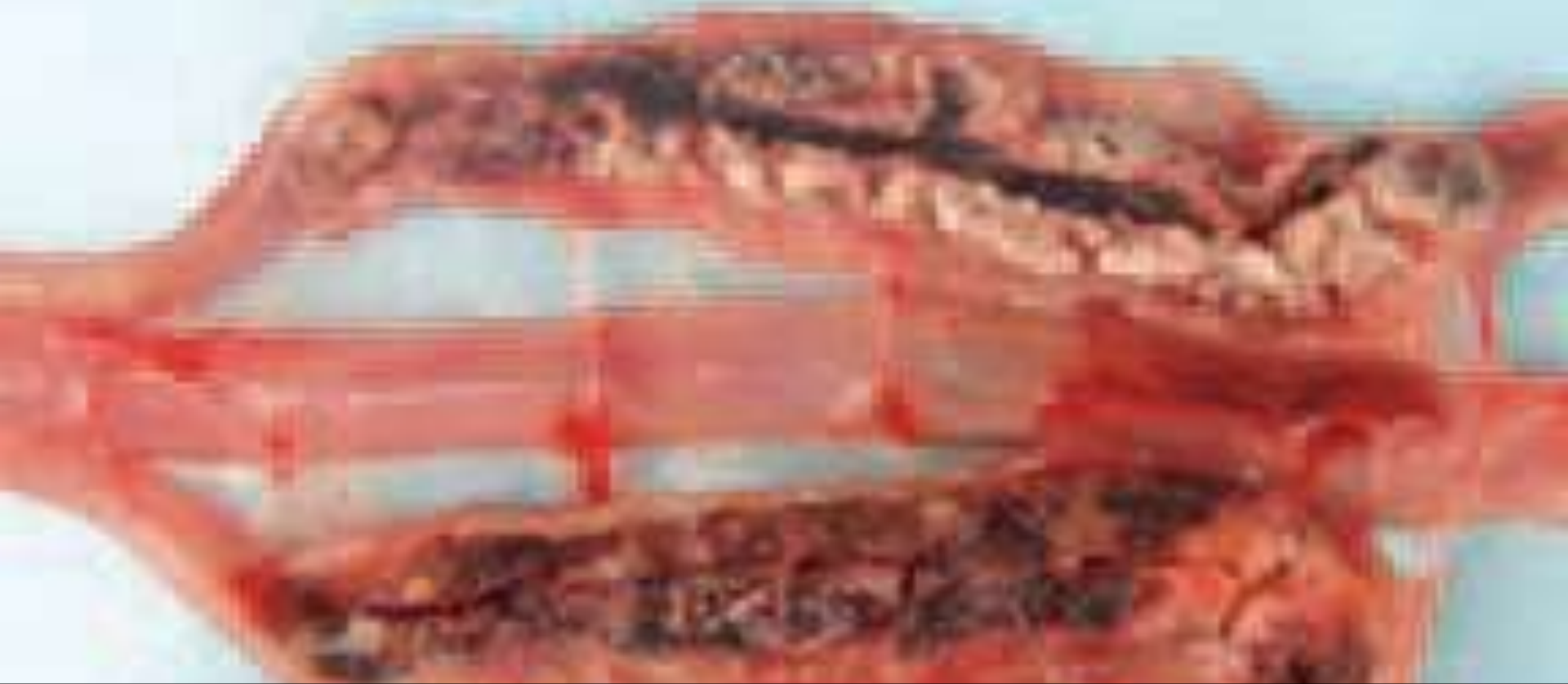
- *E. tenella*, a marked typhlitis is present and haemorrhages are seen through the intestinal wall.



- *E. tenella*, a marked typhlitis is present and haemorrhages are seen through the intestinal wall.



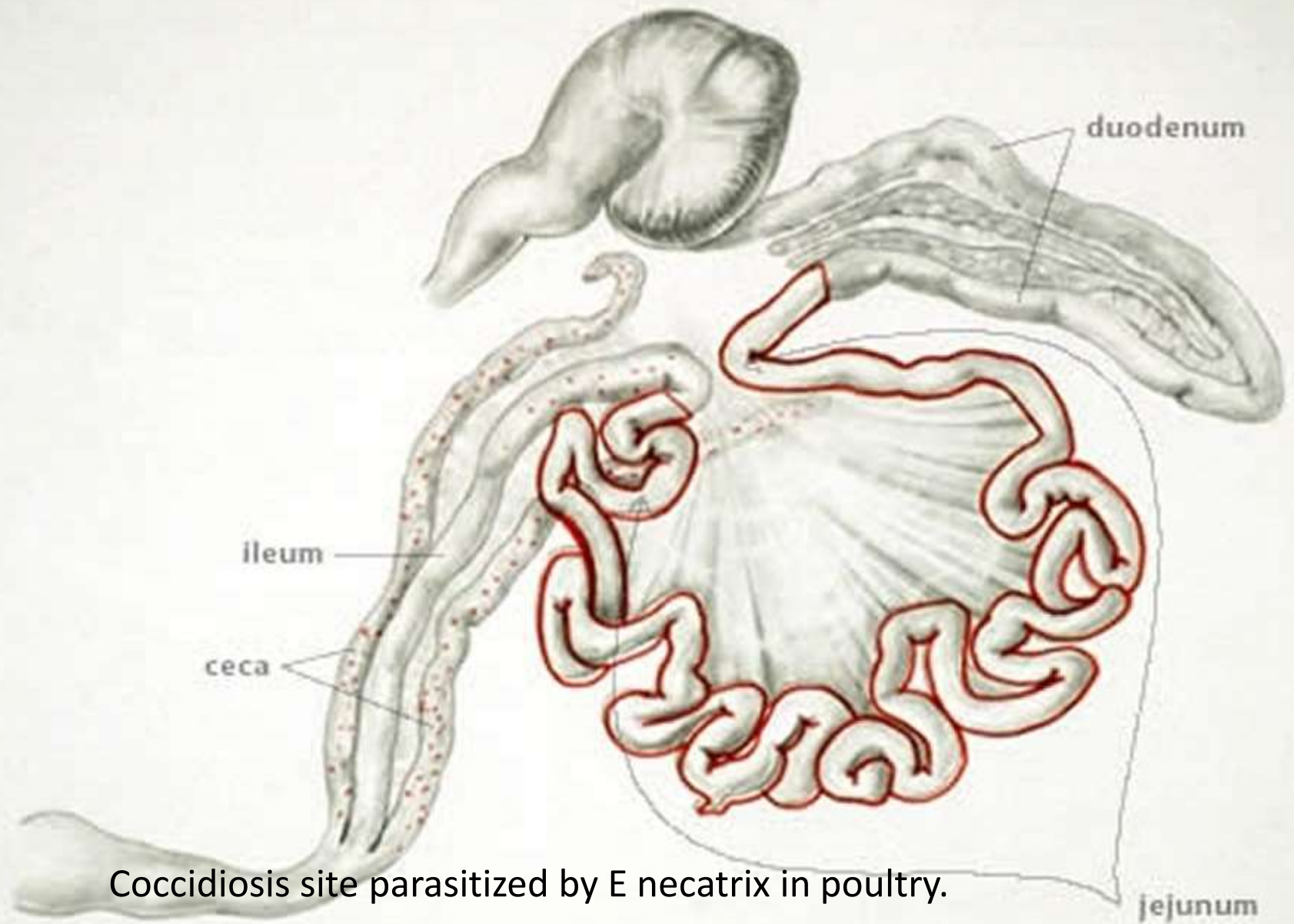
- *E. tenella*, caeca are filled with fresh or clotted blood.



- *E. tenella*, a later stage, the caecal content becomes thicker, mixed with fibrinous exudate and acquires a cheese like appearance.

E necatrix

Produces major lesions in the anterior and middle portions of the small intestine.



Coccidiosis site parasitized by *E. necatrix* in poultry.

E necatrix

- Small white spots, usually intermingled with rounded, bright- or dull-red spots of various sizes, can be seen on the serosal surface.
- This appearance is sometimes described as “salt and pepper.”
- The white spots are diagnostic for *E necatrix* if clumps of large schizonts can be demonstrated microscopically.

Cont. ...

In severe cases

1. The intestinal wall is thickened.
2. The infected area dilated to 2–2.5 times the normal diameter.
3. The lumen may be filled with blood, mucus, and fluid.
4. Fluid loss may result in marked dehydration.

Cont. ...

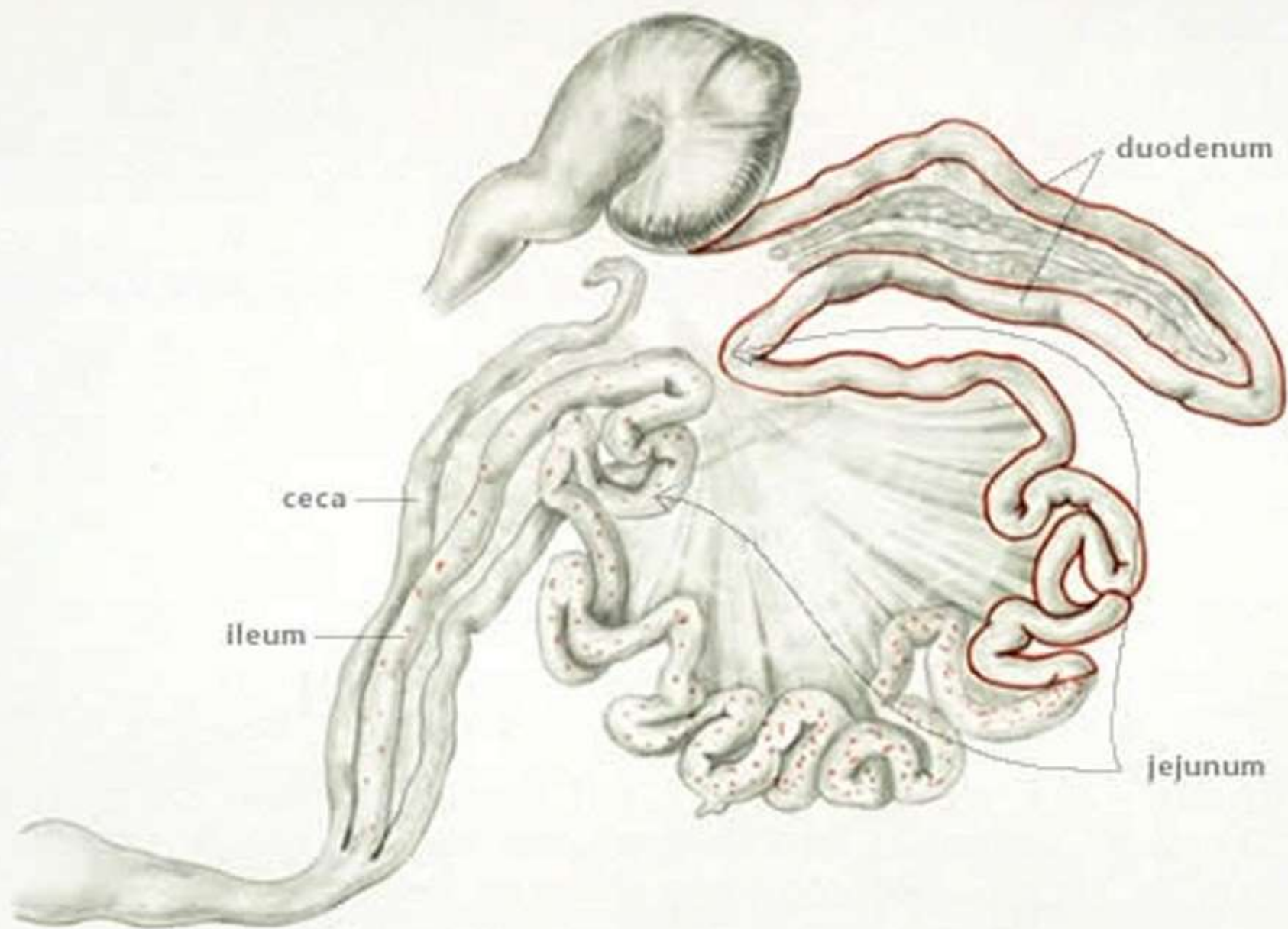
- Although the damage is in the small intestine, the sexual phase of the life cycle is completed in the ceca.
- Oocysts of *E necatrix* are found only in the ceca.
- Because of concurrent infections, oocysts of other species may be found in the area of major lesions, misleading the diagnostician.



- Gross lesions of E necatrix with frank hemorrhaging into the mid gut in a chicken.

E acervulina

- *E acervulina* is the **most common** cause of infection.
- Lesions include **numerous whitish, oval or transverse patches** in the upper half of the small intestine, which may be easily distinguished on gross examination.
- The clinical course in a flock is usually protracted and results in poor growth, an increase in culls, and slightly increased mortality.





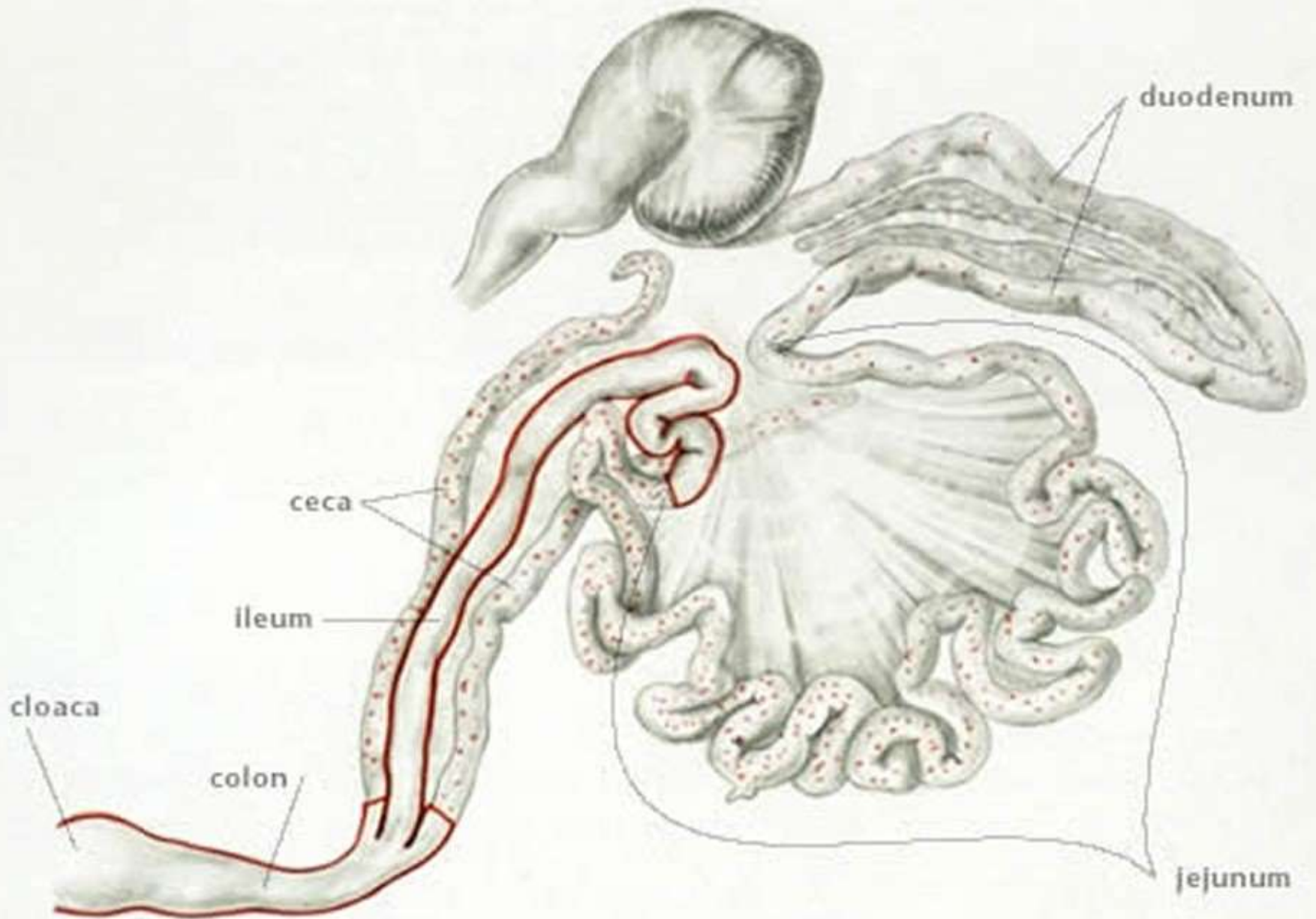
- Gross lesions of *E. acervulina* with white longitudinal plaques in the duodenal loop of a broiler chicken.



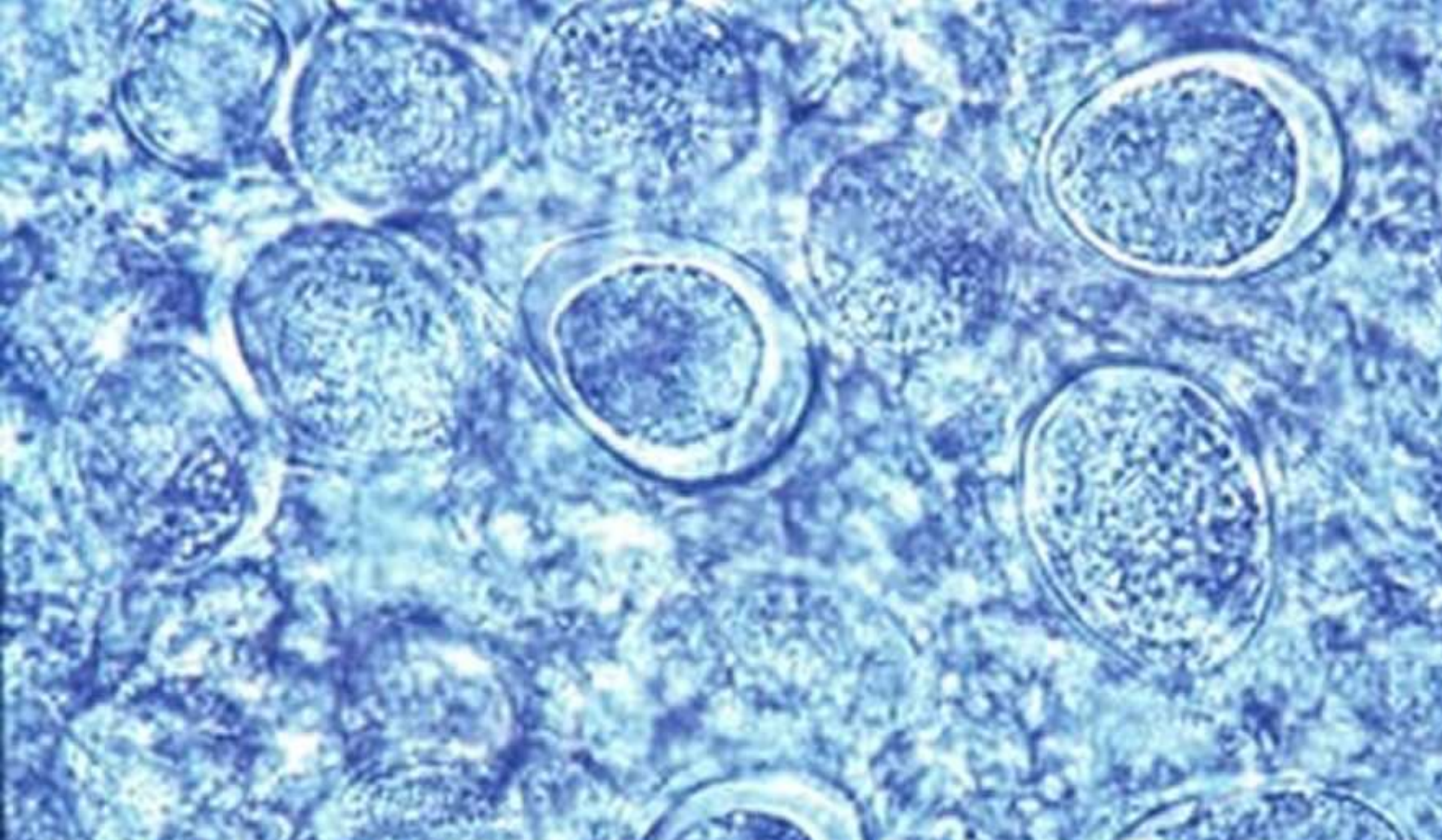
- Gross lesions of *E. acervulina* with white longitudinal plaques in the duodenal loop of a broiler chicken.

E brunetti

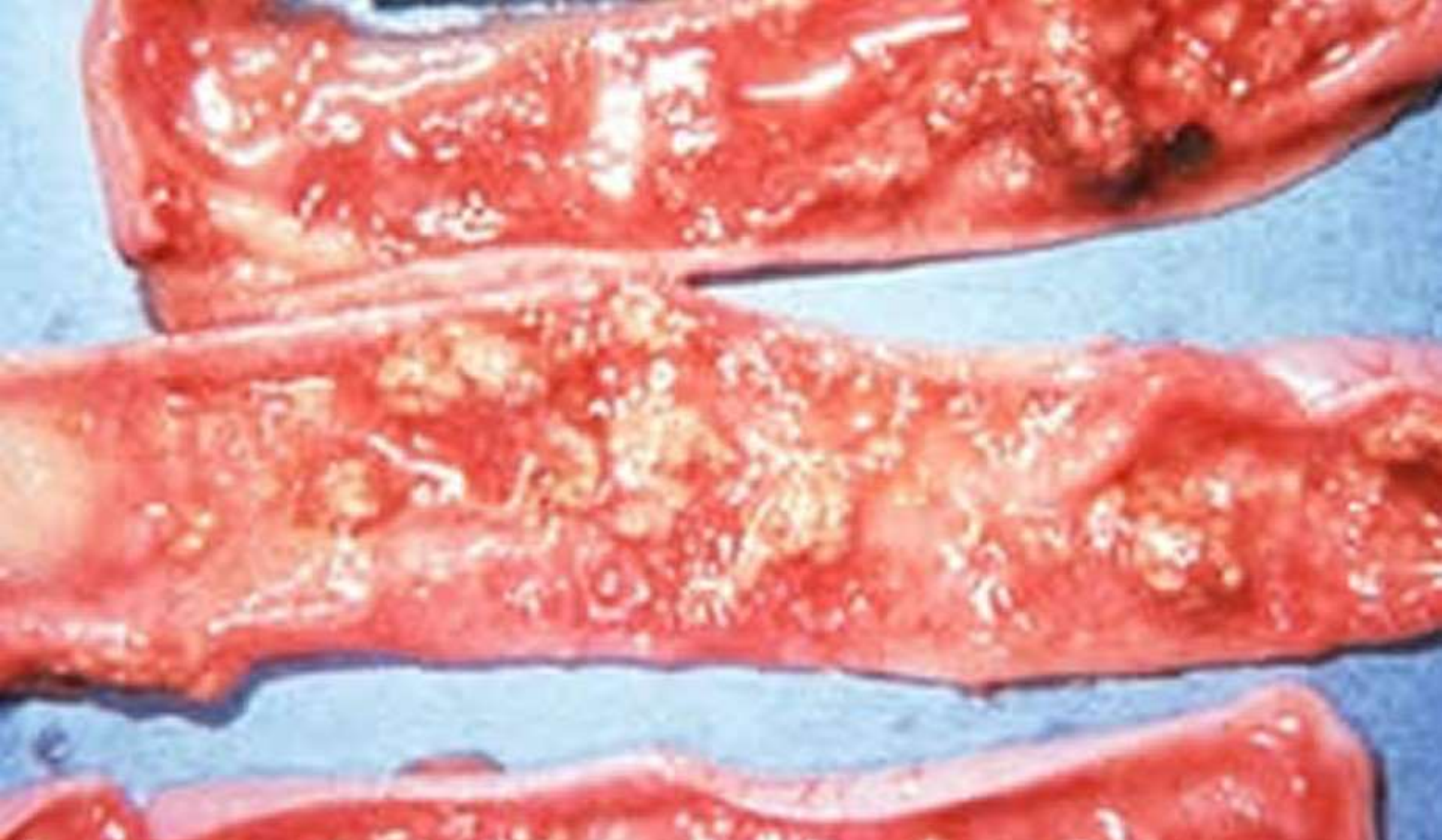
- *E brunetti* is found in the lower small intestine, rectum, ceca, and cloaca.
- In moderate infections, the mucosa is pale and disrupted but lacking in discrete foci, and may be thickened.
- In severe infections, **coagulative necrosis and sloughing** of the mucosa occurs throughout most of the small intestine.



Coccidiosis site parasitized by *E. brunetti* in poultry.



- Oocysts of *E. brunetti* from mucosal scraping of small intestine, new methylene blue, 100X.



- Oocysts of *E. brunetti* from mucosal scraping of small intestine, new methylene blue, 100X.

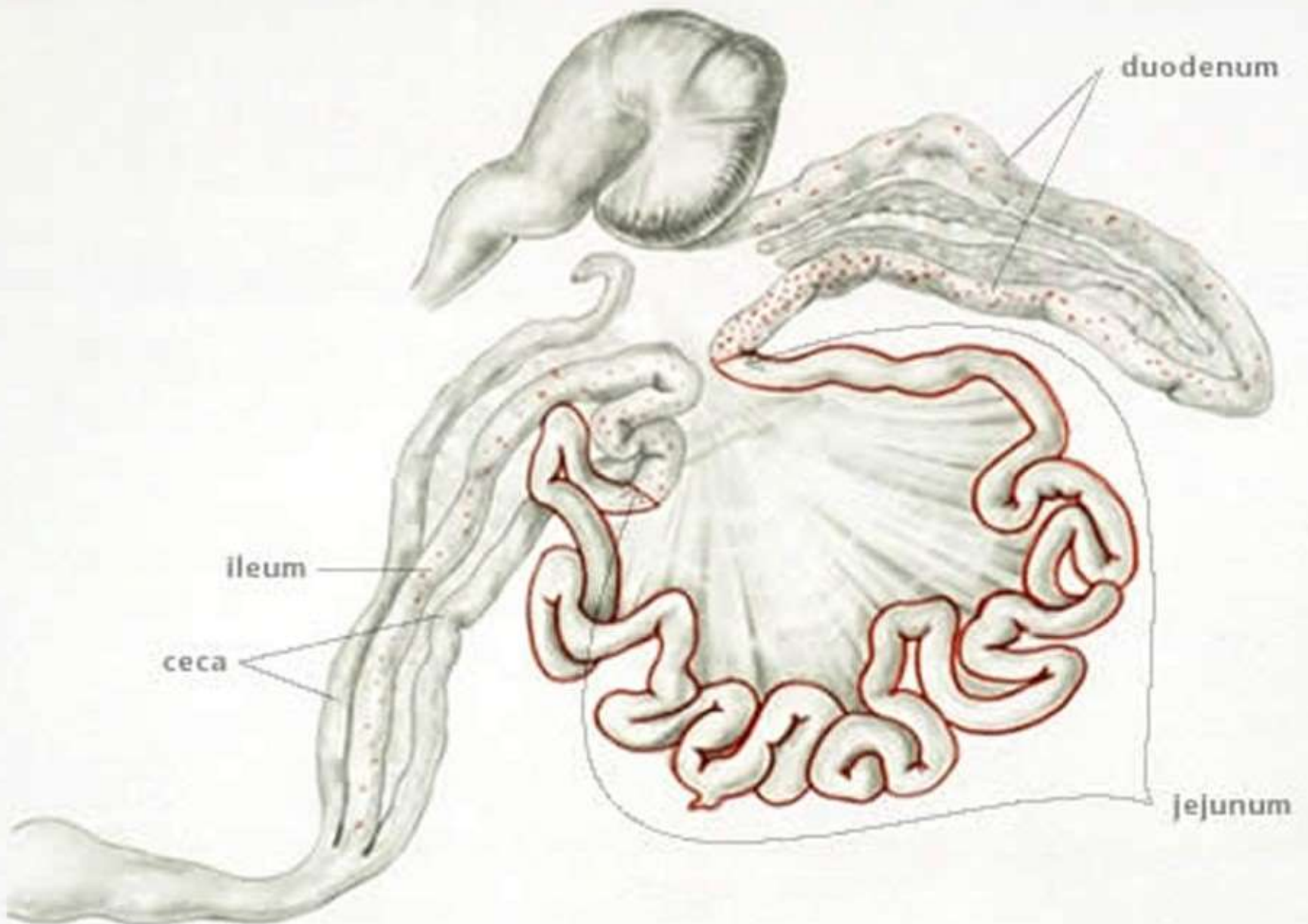
E maxima

E maxima develops in the small intestine, where it causes:

1. Dilatation and thickening of the wall.
2. Petechial hemorrhage.
3. Reddish, orange, or pink viscous mucous exudate and fluid.
4. The exterior of the midgut often has numerous whitish pinpoint foci, and the area may appear engorged.
5. The oocysts and gametocytes (particularly macrogametocytes), which are present in the lesions, are distinctly large.



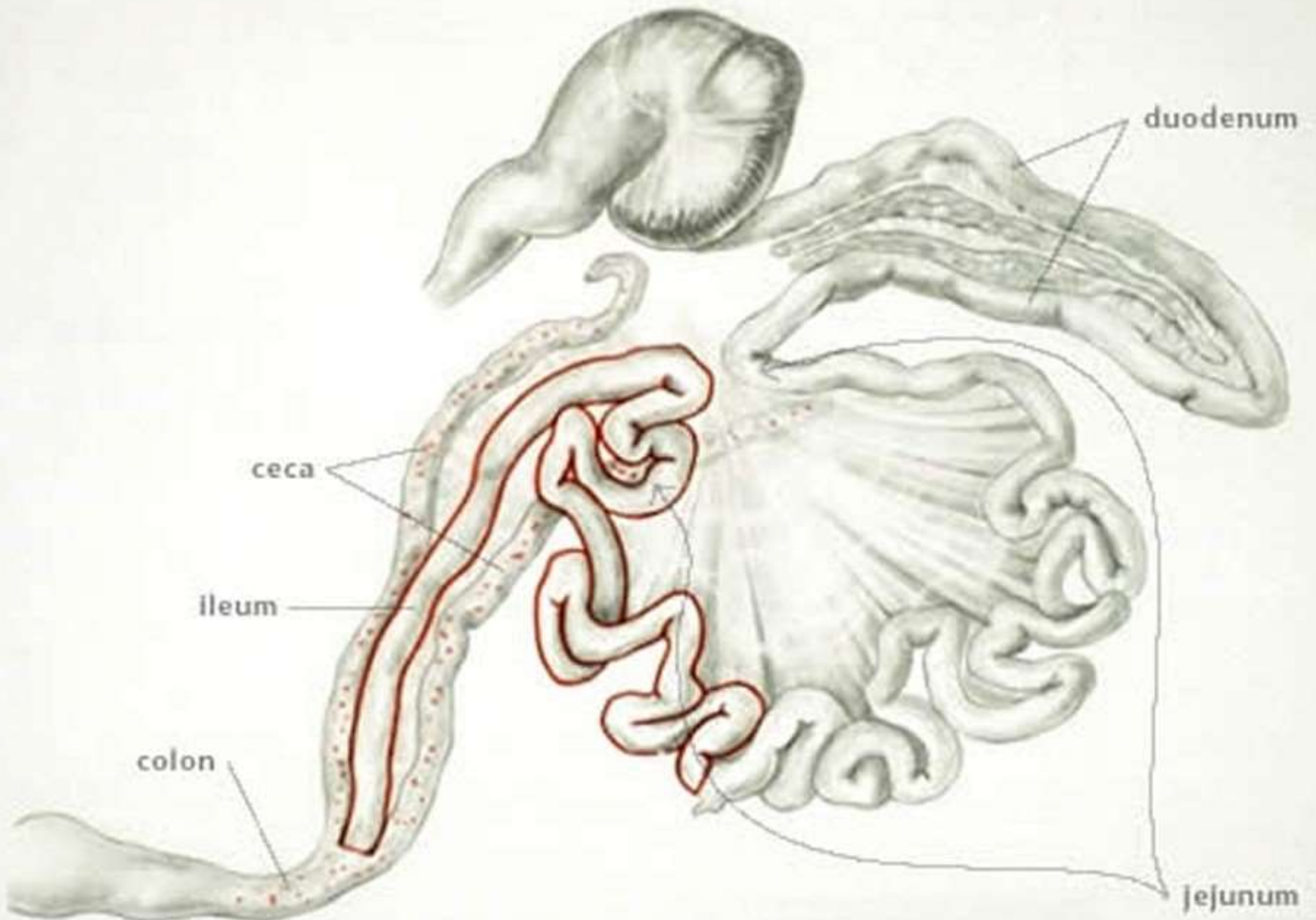
- Oocysts of *E. maxima*, 100X.



Coccidiosis site parasitized by *E. maxima* in poultry.

E mitis

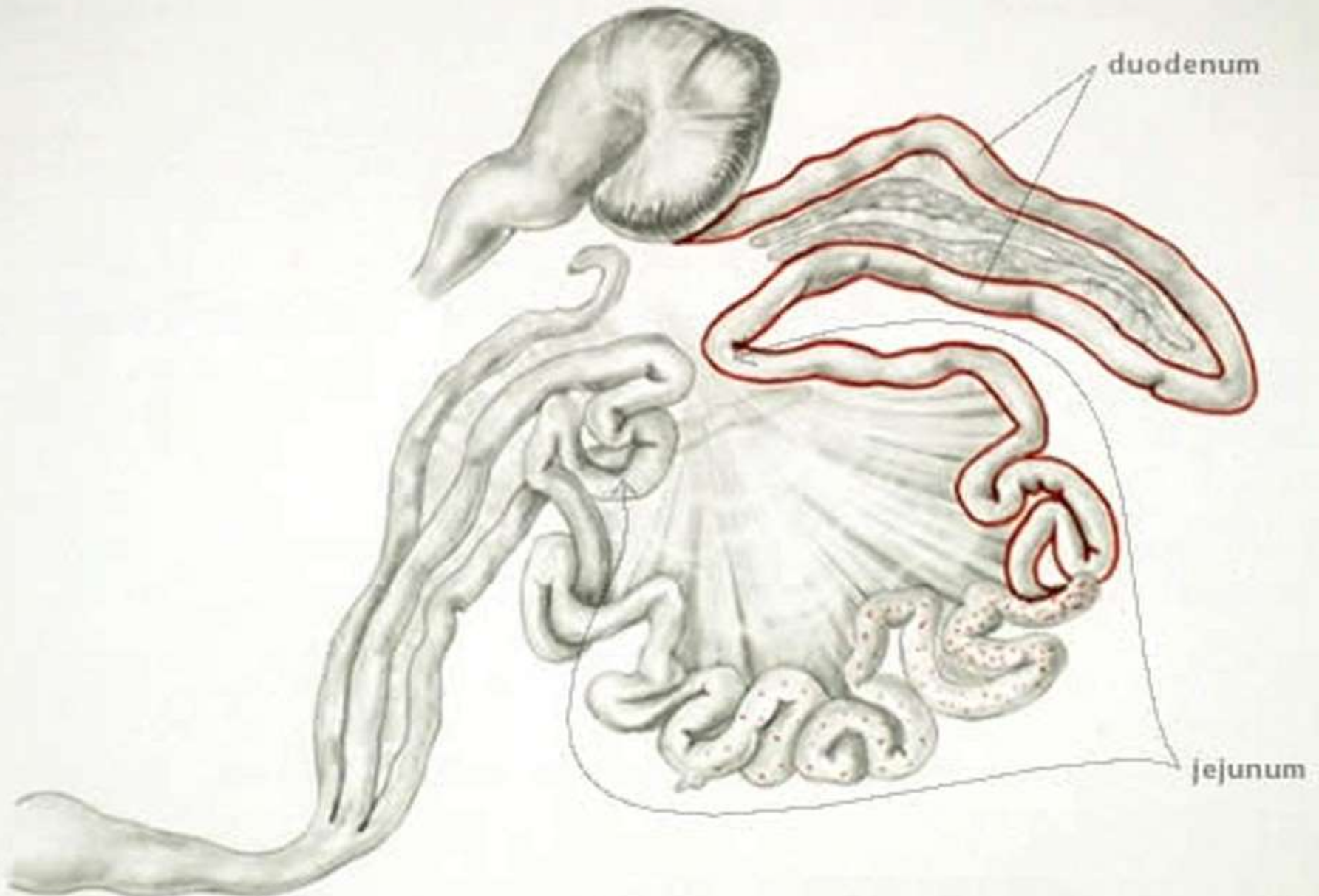
- It is recognized as pathogenic in the lower small intestine.
- Lesions are indistinct but may resemble moderate infections of *E brunetti*.
- *E mitis* can be distinguished from *E brunetti* by finding small, round oocysts associated with the lesion.



Coccidiosis site parasitized by *E. mitis* in poultry.

E praecox

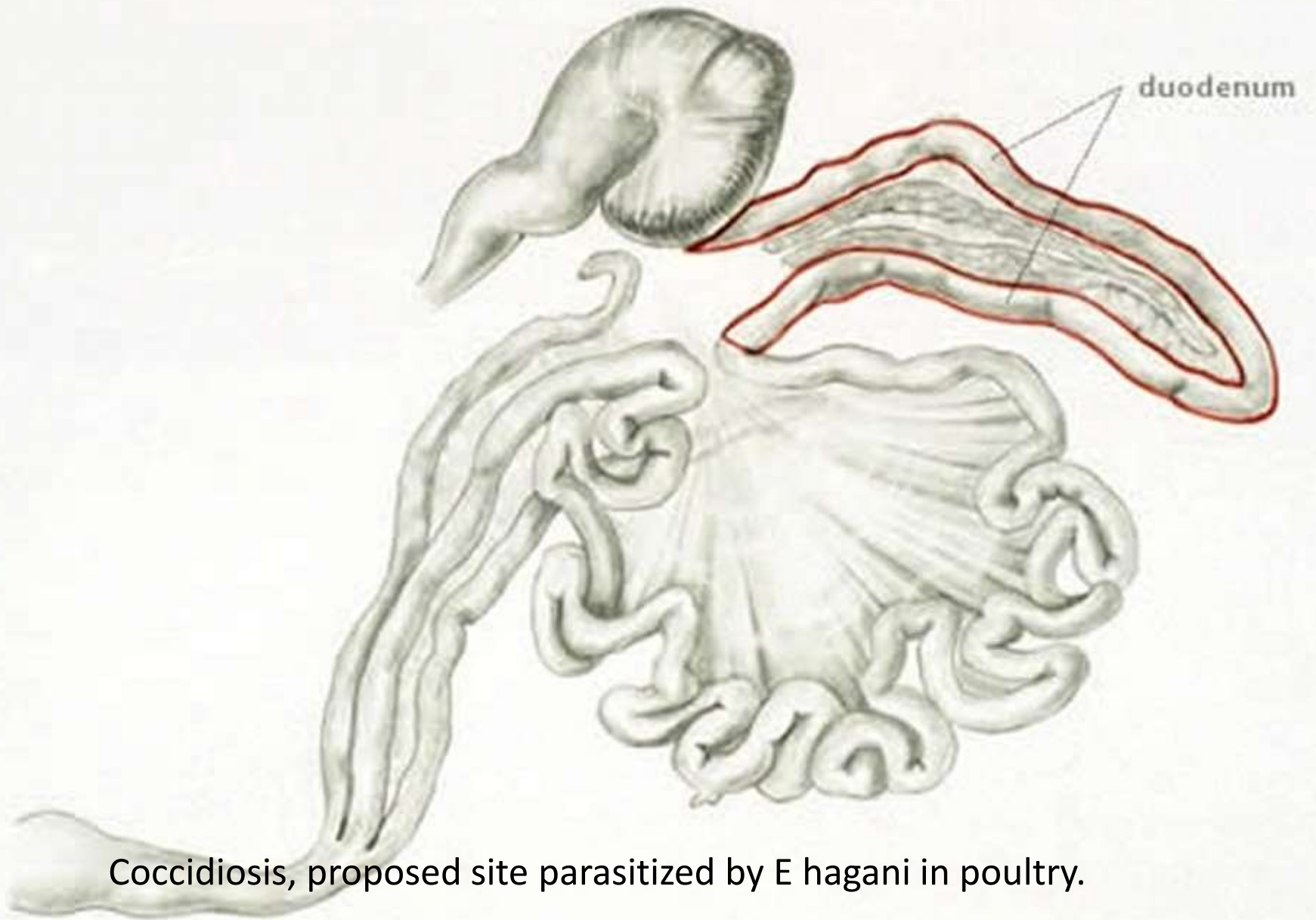
- *E praecox*, which infects the upper small intestine, **does not cause distinct lesions** but may decrease rate of growth.
- The oocysts are larger than those of *E acervulina* and are numerous in affected areas.
- **The intestinal contents may be watery.**
- *E praecox* is considered to be of less economic importance than the other species.



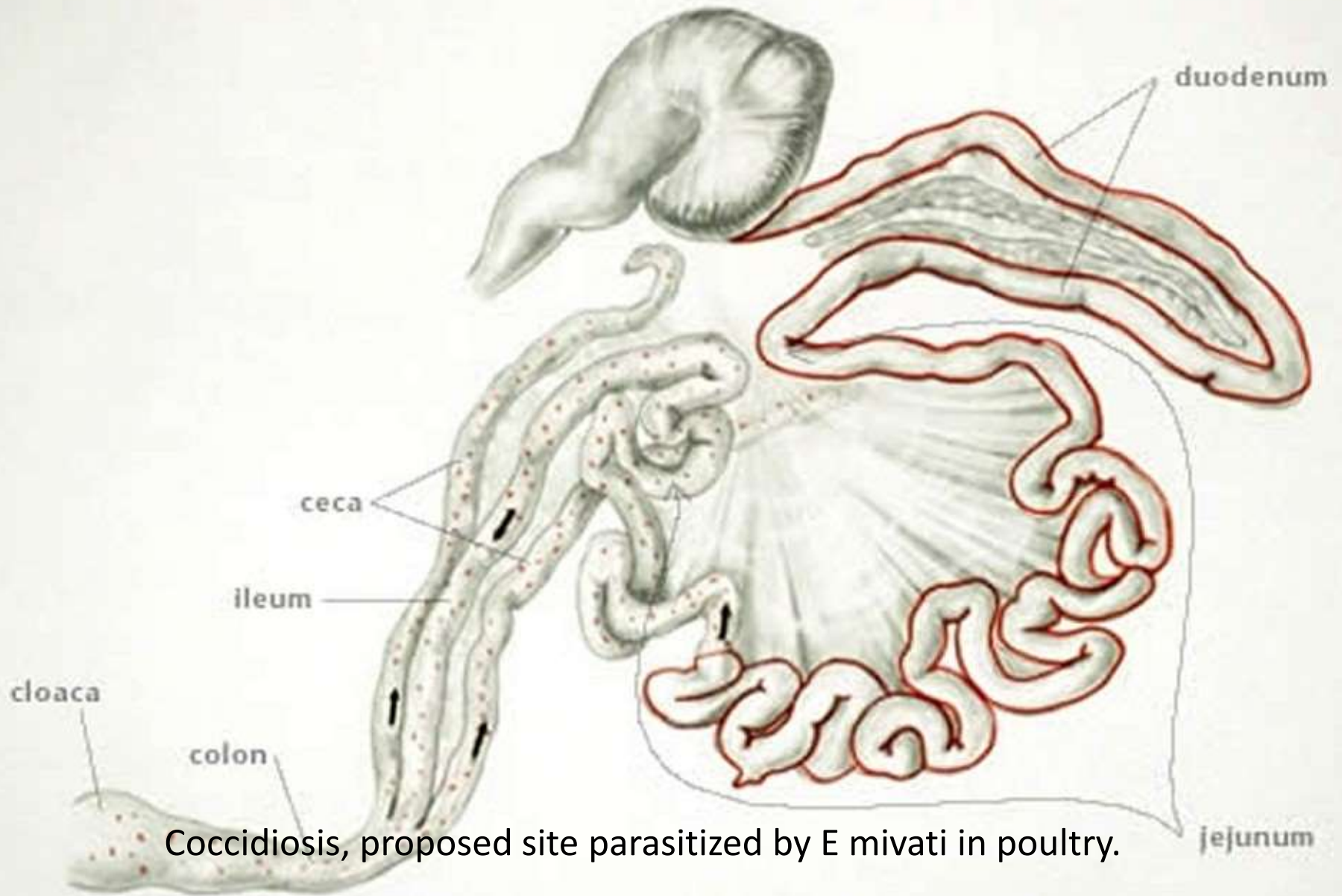
Coccidiosis site parasitized by *E. praecox* in poultry.

E hagani and *E mivati*

- *E hagani* and *E mivati* develop in the anterior part of the small intestine.
- The lesions of *E hagani* are **indistinct and difficult to characterize.**
- However, *E mivati* may cause severe lesions similar to those of *E acervulina*.



Coccidiosis, proposed site parasitized by E hagani in poultry.



Coccidiosis, proposed site parasitized by *E. mivati* in poultry.

Cont. ...

- In severe infections, *E mivati* may cause reddening of the duodenum because of denuding of the villi.
- Some consider these species to be of dubious provenance, but work with molecular diagnostics seems to support their validity.

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Diagnosis

Diagnosing the Eimeria infection by;

1. Case history
2. Laboratory
3. Necropsy of several fresh specimens.

Cont. ...

Case History

1. Severity of lesions
2. Flock appearance
3. Morbidity
4. Daily mortality
5. Feed intake
6. Growth rate
7. Rate of lay

Cont. ...

Laboratory diagnosis

By demonstration of oocysts in feces or intestinal scrapings.

Cont. ...

Necropsy of several fresh specimens to determine the infective *Eimeria* specie agent by;

1. Location in the host
2. Appearance of lesions

Notes

- Classic lesions of *E tenella* and *E necatrix* are pathognomonic, but infections of other species are more difficult to diagnose.
- Mixed coccidial infections are common.

Cont. ...

Subclinical coccidial

- Subclinical coccidial infections may be unimportant, and poor performance may be caused by other flock disorders.

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Control

- Practical methods of management cannot prevent coccidial infection.
- Poultry that are maintained at all times on wire floors to separate birds from droppings have fewer infections; clinical coccidiosis is seen only rarely under such circumstances.

Control

Methods of control are:

1. Management
2. Vaccination

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Management

- Management has always been important to coccidiosis control, especially before drugs were available.
- Management focuses on reducing the number of coccidia to keep infection at a minimum until immunity is established.

Management

Management is applied through;

1. Natural immunity
2. Early detection
3. Production system
4. Brooder and grow-out management
5. Sanitation
6. Litter management

1- Natural Immunity

- In a small-scale, low-density production system;
 - There are low level of exposure to coccidia.
 - This permits the chick to develop immunity without triggering the disease.

Cont. ...

- Individually, birds may not pick up enough parasites to cause immunity, or they may be overwhelmed by too many.
- Immunity is species-specific.
 - Exposure to one type of coccidia will not protect a chicken from the other types that can infect it.



2- Early Detection

- Early detection is a management method to avoid the use of preventative medication.
- If you can catch the disease when it initially infects only a few birds, you may have time to treat these birds with a rescue drug or make a management change.
- Early detection requires close observation and experience.
- **Watch feed intake** in particular, it goes down in the early stages of coccidiosis.

3- Production System

- The choice of production system is an important management decision.
- High-density, large-scale production always requires the use of anticoccidial medication.

Cont. ...

- In contrast, in low-density, small-scale production, the birds tend to stay ahead of the parasites and may not require medication.
- Many small-scale producers do not use anticoccidial medication; however, as the size of the flocks grows, more problems are encountered and more management is required for natural immunity.

4- Brooder and Grow-out Management

- If chicks are brooded and grown out in the same facility (one-stage production), they seed the area with coccidia.
- These birds may require a lower density or, possibly, medication.

Cont. ...

The following management strategies for good brooding can help.

1. Give birds adequate floor space and feeder/waterer space to prevent overcrowding.
2. Keep the feeders full. If feeders go empty, birds forage in the litter and ingest oocysts.
 - The longer they peck at contaminated litter, the more oocysts they will ingest.

5- Sanitation

Disinfectants are not effective against coccidia, so sanitation focuses on good hygiene and removing infected droppings.

Cont. ...

1. Put waterers and feeders at a height level with the backs of the birds, so they cannot defecate or scratch litter into them.
2. Keep birds from roosting on the feeders with anti-roosting wire.
3. Suspend waterers or put them on wire-covered platforms to help keep them clean.
4. Clean the waterers and feeders frequently.
5. Keep older birds away from chicks, since old birds are carriers.
6. Add fresh litter or rake litter frequently to cover parasites.

6- Litter Management

- Keep the litter dry to reduce sporulation of oocysts.
- Remove any wet or crusted litter.

Cont. ...

Moisture in the litter is affected by the following:

1. Heat source:

- A propane radiant brooder heats a larger area and dries out litter more than a heat lamp.

2. Ventilation:

- Housing should prevent drafts but not be airtight. Humidity, along with ammonia and other gases, needs to escape.

3. Water leaks:

- Water leaks must be prevented.



Cont. ...

4. Condensation:

- Condensation may occur in buildings with uninsulated roofs and walls and will contribute to litter moisture.

5. Feed:

- Rations with excessive protein or excessive salt can result in wet litter.

Cont. ...

Old litter

- Poultry-house litter becomes significantly anti-coccidial after about six months' use, as organisms that eat coccidia start to thrive and knock down the coccidia population.
- By never removing more than half the brooder house litter at a time, it can keep its anti-microbial properties indefinitely.

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Vaccination

- Species-specific immunity usually develops after natural infection, primarily a T-cell response, a cell mediated immunity.
- The degree of immunity depends on the extent of infection and the number of re-infections.

Commercial Vaccines

Composition

- **Low doses** of live (not attenuated) sporulated oocysts of the various coccidial species.

Administration

- At one day-old chicks, either at the hatchery or on the farm.

Cont. ...

- Because the vaccine serves only to introduce infection, chickens are reinfected by progeny of the vaccine strain on the farm.
- The self-limiting nature of coccidiosis and the low dose of oocysts are considered a replacement of biologic attenuation.

Main Characteristics Of Eimeria Species

Species	Site of development		Pathogenicity
<i>E. praecox</i>	Duodenum, jejunum	Least pathogenic	<ul style="list-style-type: none"> • Watery intestinal contents • Mucus and mucoid casts
<i>E. hagani</i>	Duodenum, jejunum and ileum	Least pathogenic	<ul style="list-style-type: none"> • Petechiae and white opacities in the upper small intestine • Intestinal content may be creamy or watery
<i>E. acervulina</i>	Duodenum, ileum	Less pathogenic	<ul style="list-style-type: none"> • Limited enteritis causing fluid loss. • Malabsorption of nutrients.
<i>E. mitis</i>	Ileum	Less pathogenic	<ul style="list-style-type: none"> • Limited enteritis causing fluid loss. • Malabsorption of nutrients
<i>E. mivati</i>	Duodenum, rectum	Less pathogenic	<ul style="list-style-type: none"> • Red petechiae and round white spots • Severe denuding of the mucosa
<i>E. maxima</i>	Jejunum, ileum	Moderately-Highly pathogenic	<ul style="list-style-type: none"> • Inflammation of the intestinal wall with pinpointed hemorrhages • Sloughing of epithelia
<i>E. brunetti</i>	Caeca and rectum	Highly pathogenic	<ul style="list-style-type: none"> • Inflammation of the intestinal wall with pinpointed hemorrhages • Sloughing of epithelia
<i>E. tenella</i>	Caeca	Highly pathogenic	<ul style="list-style-type: none"> • Thickened cecal wall and bloody contents at the proximal end • Distension of caecum • Villi destruction causing extensive hemorrhage and death
<i>E. necatrix</i>	Jejunum, ileum, caeca	Highly pathogenic	<ul style="list-style-type: none"> • Intestine may be ballooned • Mucosa thickened and the lumen filled with fluid, blood and tissue debris • Lesions in dead birds are observable as black and white plaques (salt and pepper appearance)