

Conditions detected at meat inspection and their judgments

DISEASES CAUSED BY VIRUSES

Foot and mouth disease (FMD, Aphthous fever)

FMD is an acute viral and extremely contagious disease of cloven footed animals. There are three main strains of viruses causing FMD, namely A, O and C. Three additional strains, SAT 1, SAT 2 and SAT 3 have been isolated from Africa and a further strain ASIA-1 from Asia and the Far East.

Antemortem findings:

Before vesicle formation:

1. Incubation is 1 - 5 days or longer, Morbidity: Nearly 100 %
2. Mortality: variable depending on the strain of virus and its virulence and susceptibility of host; 50 % in young animals, 5 % in adults
3. Fever up to 41.7°C, dullness, lack of appetite and drastic drop in milk production.
4. Uneasiness and muscle tremors

After vesicle formation:

Smacking and quivering of lips, extensive salivation and drooling, shaking of feet and lameness.

The vesicles and later erosions are commonly found on the muzzle, tongue, oral cavity, teat and on the skin between and above the hoofs of the feet. In more chronic cases in cattle the hoof become loose and the animal may walk with characteristic “clicking” sound (Slippering).

Some strains of FMD, particularly in swine, sheep and goats cause erosions instead of vesicles.

Postmortem findings:

1. Necrosis of heart muscle (tiger heart), usually only in young acutely infected animals.
2. Ulcerative lesions on tongue, palate, gums, pillars of the rumen and feet.

Judgement: In countries or in zones within a country free or nearly free of FMD diseased or suspect animals are *prohibited to be admitted in an abattoir* or slaughtered. If FMD is suspected on postmortem examination the carcass and viscera are *condemned* and appropriate action recommended by the regulatory authorities of the country must be taken. In countries where this disease is present, the judgement should be *in accordance with the current animal health requirements*, and consisted with effective public health protection. Particular attention should be paid to secondary bacterial infections and general findings. Sanitary measures should be taken to comply with national animal health policy.

Rinderpest (RP):

Rinderpest is an acute, highly contagious, fatal viral disease of *cattle, buffalo* and *wild ruminants* manifested by inflammation, haemorrhage, erosions of the digestive tract, wasting and often bloody diarrhoea. Some swine species are also susceptible. Man is not susceptible to RP virus.

Ante mortem findings:

1. Incubation: 3 – 10 days or longer
2. Morbidity: Up to 100 % in a susceptible herd and mortality: 50 % and may reach 90 – 95 %.
3. High fever (41–42°C), nasal discharge and excessive salivation
4. Punched out erosions in the mouth , loss of appetite , depression and abdominal pain (grunting, arched back)
5. Constipation followed by bloody diarrhoea , straining, dehydration and rough hair coat.
6. Marked debility, abortion and classical “milk fever position” in cattle

Postmortem findings :

1. Punched out erosions in the oesophagus, edema or emphysema of the lungs.
2. Haemorrhage in the spleen, gallbladder and urinary bladder

3. Haemorrhagic or ulcerative lesions in the omasum
4. Congested abomasum filled with bloody fluid. Ulcers may also be observed.
5. Severe congestion and haemorrhage in the intestine and enlarged and necrotic Peyer's patches.
6. Last portion of the large intestine and rectum are haemorrhagic showing "tiger stripping" of longitudinal folds
7. Enlarged and edematous lymph nodes, emaciated carcass

Judgement : The carcass derived from a feverish and debilitated animal showing the sign of acute disease on antemortem examination should be *condemned*. In the areas free of RP and in zones where final stages of eradication exist, the animals are also condemned. In endemic zones, if acute symptoms of the disease are not present during clinical examination, the carcass *may have limited distribution*. In areas affected with outbreak which are protected by vaccination, *heat treatment of meat is suggested* if economically worthwhile. The affected organs are *condemned*.

Vesicular stomatitis (VS):

This is a viral disease of *ruminants, horses and swine* characterized by vesicular lesions of the mouth, feet and teats. VS virus has two immunologically distinct serotypes, Indiana and New Jersey.

Antemortem findings :

1. Fever, Mouth lesions in cattle and horses, Vesicles tend to disappear quickly and only papules may be seen in cattle outbreaks.
2. Marked weight loss and cessation of lactation in dairy cows.
3. Chewing movements and profuse salivation, Refuse food but eagerly accept water
4. Horses rub lips on edges of mangers, Foot lesions occur in about 50 % cases in cattle.
5. Lameness and Teat lesion may occur in all species.

Postmortem findings :

1. The skin and mucous membrane lesions resemble the lesions of other vesicular diseases.
2. Secondary bacterial or fungal infections
3. Mastitis

Judgement : The carcass of an animal affected with vesicular stomatitis is *approved* if the disease is not in the acute stage and secondary changes are not present. Parts of the affected carcass and organs are *condemned*. A carcass showing acute changes and systemic lesions is *condemned*. If VS is not confirmed by laboratory examination, the judgement will be the same as for the FMD.

Rabies:

This is an acute infectious viral disease of the central nervous system in mammals.

Transmission : It is usually transmitted through the saliva by a bite from a rabid animal, commonly the dog or jackal. Man is infected the same way.

Antemortem findings :

Furious form

Incubation from 2 weeks to 6 months or longer, Restlessness, Aggressive, may attack other animals, Sexual excitement, Bellowing, Paralysis and death

Paralytic form

Sagging and swaying of the hind quarters, Drooling and salivation, the tail is held to one side, Tenesmus or paralysis of the anus, Paralysis, The animal falls to the ground, Death after 48 hours of decubitus

Postmortem findings: Possible inflammation of gastrointestinal mucosa

Judgement: In endemic areas carcasses *may be approved* if the animal was bitten eight days before slaughter and within 48 hours of slaughter. The bite area and surrounding tissue must be *condemned*.

Extreme caution should be instituted in abattoirs in order to prevent occupational hazards. Abattoir personnel can contract the disease through surface contact with infected tissue. Infection does not occur by consumption of meat from a rabid animal.

Slaughter may be prohibited during a quarantine period of 8 months following exposure to the disease. An animal suspected of having rabies should be placed under a "Held tag". The warning sign should read "The animal is not to be handled". Any person who was in touch with the animal should thoroughly wash his/her hands with strong soap and/or disinfectant. If possible, the wound should be opened to encourage bleeding in order to flush out the virus and expose the deeper area of the wound. Tincture of iodine (up to 0.001 % aqueous solution of iodine or ethanol 43.70%) should be further applied.

Lumpy skin disease:

Acute pox viral disease of *cattle* manifested with sudden appearance of nodules on the skin.

Antemortem findings :

1. Incubation: 4 – 14 days, fluctuating fever, diarrhea, nasal discharge and salivation.
2. The first lesion appears in the perineum.
3. Various sized cutaneous nodules may occur throughout the body and skin lesions may show scab formation
4. Swelling of superficial lymph nodes and limbs resulting lameness.
5. Infertility and abortion. Secondary infection may lead to joint and tendon inflammation

Postmortem findings :

1. Ulcerative lesions in the mucosa of the respiratory and digestive tract
2. Reddish, haemorrhagic to whitish lesions in the lungs
3. Edema (interlobular) and nodules in the lungs.
4. Heart lesion (endocardium)
5. Thrombosis of skin vessels followed by cutaneous infarction and sloughing.

Judgement : Carcass of an animal showing mild cutaneous lesions and no fever associated with general signs of infection is *conditionally approved* pending heat treatment. The affected parts of the carcass and organs are *condemned*, Carcass of an animal showing, on antemortem examination, generalized acute infection accompanied with fever, is *condemned*.

Infectious bovine rhinotracheitis (IBR):

IBR is a highly infectious viral respiratory disease of *cattle*, *goats* and *pigs* manifested by inflammation of respiratory passages and pustular lesions on the male and female genital organs.

Antemortem findings:

In respiratory form-

1. Incubation: 5 – 14 days , fever, nasal and ocular discharge; red, swollen conjunctiva
2. Drop in milk yield, breathing through the mouth and salivation.
3. Hyperaemia of the nasal mucosa and necrotic areas on the nasal septum, secondary bronchopneumonia and abortion

In genital form- Frequent urination and tail elevation, edematous swelling of the vulva and pustule formation on reddened vaginal mucosa. Mucoid or mucopurulent exudate in the vagina

In enteric form- Severe oral and stomach necrosis in new born animals and high mortality.

Postmortem findings:

1. Acute inflammation of the larynx, trachea and bronchi
2. Profuse fibrino-purulent exudate in the upper respiratory tract in severe cases
3. Chronic ulcerative gastro-enteritis in feedlot cattle
4. Lung emphysema
5. Secondary bronchopneumonia

Judgement: Carcass of an animal affected with **IBR** is *approved* if signs of acute infection are not present and the animal is in good body condition.

Bovine viral diarrhoea (BVD):

This is an infectious viral disease of *cattle* manifested by an active erosive stomatitis, gastroenteritis and diarrhoea.

Antemortem findings :

1. Incubation: 1 – 3 days, fever, congestion and erosions in the mucous membranes of the oral cavity, depression and anorexia ; cough, polypnea and salivation; dehydration and debilitation.
2. Foul-smelling diarrhea, cessation of rumination, reduced milk supply and abortion in pregnant cows.
3. Laminitis, congenital anomalies of the brain (cerebellar ataxia) and arthritis in young calves.

Postmortem findings :

1. Shallow erosions present on the entrance of the nostrils, mouth, pharynx, larynx, oesophagus, rumen , omasum, abomasum , caecum and less frequently in Peyer's patches in the small intestine.
2. Erythema of the mucosa with submucosal haemorrhage in the abomasum, small intestine, caecum and colon. Stripped appearance on the caecal and colon mucosa is similar to that seen in rinderpest.
3. Cerebral hypoplasia and cataracts in calves.

Judgement: Carcass and viscera of an animal, which on antemortem examination showed generalized signs of acute infection accompanied with fever and/or emaciation, are *condemned*. Chronic cases of BVD with no systemic involvement have a *favourable judgement* of carcass, viscera and organs.

Bovine spongiform encephalopathy (BSE, “Mad cow disease”):

BSE is a progressive and fatal disease of adult cattle characterized by a progressive degeneration of the central nervous system causing neurological signs in animals. Some scientists suspect that an unusual and atypical virus-like transmissible agent called a prion is associated with the etiology of BSE. Prion is the term currently used in literature.

Transmission : The ingestion of protein feed supplements prepared from sheep meat or sheep by products contaminated with scrapie virus.

Antemortem findings :

1. Incubation period 2 – 8 years , reduction in milk production, weight loss, while maintaining good appetite
2. Behaviour changes (nervousness and aggressiveness), kicking in the milking parlour

The progressive degeneration of the central nervous system causes neurologic signs:

Apprehension, teeth grinding, Tremors and abnormal ear position, abnormal posture and disorientation, incoordination and stiff gait, paresis and recumbency and death

Diagnosis can be confirmed only on the postmortem histological examination of brain tissue. Microscopic lesions include degenerative lesions of the cerebral cortex, medulla and central grey matter of the midbrain.

Judgement : Carcass is *condemned*.

BSE belongs to a group of human and animal diseases classified as transmissible spongiform encephalopathies. Significant human diseases of this group are Kuru and Creutzfeldt-Jacob's disease. Scrapie, which affects sheep and goats also belongs in this group.

Researchers are trying establishing if BSE and scrapie have the same causative agent, and if the modified form of the scrapie agent is also a possible causative agent of BSE. Prions are also the causative agents of transmissible mink encephalopathy (TME) and of chronic wasting disease (CWD) of mule deer and elk. BSE affects only adult animals and the incidence within-herd is low.

DISEASES CAUSED BY BACTERIA

Black quarter (Black leg)

Black quarter is an acute infectious disease of cattle and sheep manifested by severe inflammation of the muscle with high mortality. It is caused by *Clostridium chauvoei*.

Antemortem findings :

1. High fever (41°C), Lameness, Loss of appetite, Discoloured, dry or cracked skin
2. Stiff gait and reluctance to move, Crepitating swellings often on the hips and shoulder
3. In sheep gaseous crepitation cannot be felt before death

Postmortem findings:

1. Lying on one side with affected hind leg stuck out. Commonly seen in cattle
2. Bloating of carcass and blood stained frothy exudates from the nostrils and anus
3. Dark red to black muscle of the loin, back or leg.
4. Spongelike bubbly appearance of the muscles with a peculiar rancid odour
5. Yellowish, gelatinous subcutaneous tissue and associated gas bubbles
6. Blood stained fluid in body cavities

Judgement : Carcasses of animals affected with black leg should be *condemned*. It is prohibited to slaughter and dress an animal diagnosed with this disease at antemortem examination.

Botulism

Botulism is a disease manifested by progressive muscular paralysis. It is seen in humans, animals, birds and fish and is caused by various strains of *Clostridium botulinum*. Decomposed flesh and bones are the source of infection for animals. Incubation period 12 – 24 hours. However, 2 hours up to 14 days incubation period has been recorded.

Antemortem findings :

In cattle and horses: Restlessness, Knuckling, incoordination, Paralysed tongue and drooling of saliva.

Sternal recumbency, Progressive muscular paralysis from hindquarters to frontquarters, head and neck. Serous nasal discharge and salivation

Abdominal respiration, Stiffness upon walking and incoordination, Switching of the tail on the side, Limb paralysis and death.

In pigs: Lack of appetite, refusal to drink and vomiting, Pupillary dilatation and Muscular paralysis.

Postmortem findings: Foreign material in fore-stomachs or stomachs may be suggestive of botulism.

Judgement: Total condemnation of carcass because of human hazards.

Malignant edema

Malignant edema is a bacterial disease of cattle, sheep, goats, swine, horses and poultry. It is caused by *Clostridium septicum* and is manifested by wound infection. The infection is commonly soil-borne. Deep wounds associated with trauma provide ideal condition for the growth of this agent.

Antemortem findings :

Fever 41 – 42°C, Depression and weakness, Muscle tremor and lameness, Soft doughy swelling and erythema around the infection site.

Postmortem findings:

1. Gangrene of the skin in area of infection site, Foul putrid odour is frequently present, Gelatinous exudate in the subcutaneous and intramuscular connective tissue.
2. Subserosal haemorrhage, Accumulation of sero-sanguineous fluid in body cavities.
3. Muscle tissue is dark-red but has little or no gas

Judgement : Carcasses of animals affected with malignant edema are *condemned*.

Tuberculosis:

Tuberculosis is a chronic disease of many animal species and poultry caused by bacteria of the genus *Mycobacterium*. It is characterized by development of tubercles in the organs of most species. Bovine tuberculosis is caused by *Mycobacterium bovis*. It is a significant zoonotic disease.

Antemortem findings:

1. Low grade fever, Chronic intermittent hacking cough and associated pneumonia.
2. Difficult breathing, Weakness and loss of appetite, Emaciation, Swelling of superficial body lymph nodes

Postmortem findings:

1. Tuberculous granuloma in the lymph nodes of the head, lungs, intestine and carcass. These have usually a well defined capsule enclosing a caseous mass with a calcified centre. They are usually yellow in colour in cattle, white in buffaloes and greyish white in other animals.
2. Active lesions may have a reddened periphery and caseous mass in the centre of a lymph node.
3. Inactive lesions may be calcified and encapsulated
4. Nodules on the pleura and peritoneum
5. Lesions in the lungs, liver, spleen, kidney
6. Bronchopneumonia, Firmer and enlarged udder, particularly rear quarters
7. Lesions in the meninges, bone marrow and joints

The diagnosis may be confirmed by making a smear of the lesion and with Ziehl-Neelsen. The TB bacterium is a very small red staining bacillus.

Judgement: Carcass of an animal affected with tuberculosis requires additional postmortem examination of the lymph nodes, joints, bones and meninges. It is suggested that the Codex Alimentarius judgement recommendations for cattle and buffalo carcasses be followed.

Carcasses are *condemned*

- i. where an eradication scheme has terminated or in cases of residual infection or re-infection
- ii. in final stages of eradication - natural prevalence low
- iii. during early stages in high prevalence areas

Carcass of a reactor animal without lesions *may be approved* for limited distribution. If the economic situation permits, this carcass should be *condemned*. *Heat treatment* of meat is suggested during early and final stages of an eradication programme: in low and high prevalence areas where one or more organs are affected, and where miliary lesions, signs of generalization or recent haematogenous spread are not observed. If the economical situation permits, then the carcass is *condemned*.

In some countries, the carcass is *approved* if inactive lesions (calcified and/or encapsulated) are observed in organs and without generalization in lymph nodes of carcass.

Johne's disease (Bovine paratuberculosis)

Johne's disease is a chronic, infectious bacterial disease of adult wild and domestic ruminants such as cattle, sheep, and goats. It is characterized by the thickening and corrugation of the wall of the intestine, gradual weight loss and chronic diarrhoea and is caused by *Mycobacterium paratuberculosis*.

1. The agent is persistent in soil, pasture, manure and stagnant water for prolonged period.
2. Carrier animals, so called "faecal shedders", are the most important source of infection.
3. Ingestion of organism. Calves may become infected from a nursing infected dam.
4. Transmission with semen and in-utero are minor source of infection

Antemortem findings :

1. Incubation period 2 - 3 years with range from 6 months to 15 years.

2. Indifferent animal which stops eating at the end of the disease
3. Gradual and chronic weight loss and emaciation
4. Rough hair coat and dry skin
5. Non responsive diarrhoea with watery fluid faeces
6. Submandibular edema ("bottle jaw"), Reduced milk production, Mastitis and infertility
7. Debility and death

Postmortem findings :

1. Thickened and corrugated intestinal mucosa. Enlarged caecal lymph nodes

Judgement : Carcass of an animal affected with Johne's disease is *approved* when generalized systemic signs of disease are not present. A poor, thin and slightly moist carcass should be held in the chiller and assessed after 24 or 48 hours. If the dryness and setting of the carcass improves during this time it can be *released*. The carcass with associated edema and emaciation is *condemned*.

Leptospirosis :

Leptospirosis is an important and relatively common disease of domestic and wild animals and humans. In cattle, it is manifested by interstitial nephritis, anaemia and mastitis and abortion in most species. *Leptospira spp.* are the causative agents.

Antemortem findings :

Acute and subacute forms

1. Transient fever, Loss of appetite, Lactating cows may stop milking,
2. Mastitis, Milk may be yellow, clotted and frequently blood stained

Severely affected animals shows Jaundice , anaemia and pneumonia . Abortion with frequent retention of the placenta (afterbirth)

Postmortem findings :

1. Anaemia and jaundice, Subserosal and submucosal haemorrhage
2. Ulcers and haemorrhages in the abomasal mucosa
3. Rarely pulmonary edema or emphysema
4. Interstitial nephritis and Septicaemia

Judgement : Carcass of an animal affected with acute leptospirosis is *condemned*. A chronic and localized condition may *warrant an approval* of the carcass.

Leptospirosis is a zoonosis and is also an occupational hazard for farmers, veterinarians and butchers. Human infection may occur by contamination with infected urine and urine contents. The bacteria may be also found in milk in acute cases; however, it does not survive for long period of time in milk. Pasteurization will also kill leptospiras. They can survive for months in moist and humid environments, particularly in swamps, ponds and streams or poorly drained pastures.

Brucellosis (contagious abortion, Bang's disease)

Brucellosis of cattle is an infectious, contagious disease caused by *Brucella abortus* and is characterized by abortion in late pregnancy and a high rate of infertility. *B. melitensis* affects goats, *B. ovis* sheep and *B. suis* swine. *B. abortus* may occur in horses.

An uninfected animal may become infected with Brucella organisms by contaminated feed, pasture, water, milk, by an aborted fetus, fetal membranes and uterine fluid and discharges. The disease may also be spread by dogs, rats, flies, boots, vehicles, the milking machine and other equipment used in the barn. The Brucella organism may be occasionally shed in urine.

Antemortem and postmortem findings:

In cattle:

1. Abortion in non vaccinated pregnant cows in the last 3 - 4 months of pregnancy
2. Occasional inflammation of testes and epididymis
3. Swelling of scrotum (one or both sacs)
4. Edematous placenta and fetus

5. Hygromas on the knees, stifles, hock and angle of the haunch, and between the nuchal ligament and the primary thoracic spines.

In sheep:

6. Fever, increased respiration and depression
7. Inferior quality of semen in rams
8. Edema and swelling of scrotum .
9. In chronic stage enlarged and hard epididymis, thickened scrotal tunics and frequently atrophic testicles
10. Infertility in rams and abortion in ewes

Judgement: Cattle and horse carcasses affected with brucellosis are *approved* (after removal of affected parts), as *Brucella* bacteria remain viable for only a short period in the muscles after slaughter. In acute abortive form (after the miscarriage), cattle carcasses are *condemned*. Pig, sheep, goat and buffalo carcasses require *total condemnation*. *Heat treatment* may be recommended in some areas for these species due to economic reasons. Affected part of the carcass, udder, genital organs and corresponding lymph nodes must be *condemned*.

Reactor animals should be carefully handled during slaughter and dressing procedures. Gloves and goggles should be worn when known reactors are being slaughtered and hygroma lesions should be sprayed liberally with 1 % lactic acid at meat inspection.

In *humans*, brucellosis is called “Undulant Fever”. The general population is not at risk with this disease if high levels of hygiene and sanitation are practised. Pasteurized milk is brucella-free. Affected humans will suffer from intermittent high fever, headache and generalized malaise.

Brucellosis is an important zoonosis in particular in rural areas in developing countries and is an important occupational hazard for veterinarians, meat inspectors, farmers, animal health inspectors and butchers.

Anthrax :

Anthrax is a peracute disease of ruminants manifested with septicemia, sudden death and tarry blood from the body openings of the cadaver. It is caused by *Bacillus anthracis*. Man may contract anthrax by inhalation, ingestion and through a wound in the skin. Biting flies have been shown to be transmitters.

Antemortem findings:

The peracute and acute forms in cattle and sheep are without clinical signs. Death may follow in the acute form after 1 – 2 hours of illness. The acute form lasts about 48 hours.

In pigs and horses this disease is usually localized and chronic and is often characterized by swelling around the throat and head.

Antemortem findings in pigs:

1. Incubation 1 – 2 weeks.
2. Edematous swelling of the throat and neck.
3. Swallowing and breathing difficulties.
4. Death due to choking or toxemia .
5. Septicemia is not observed.

Postmortem findings:

1. Dark-tarry blood discharge from body orifices.
2. Absence of rigor mortis.
3. Haemorrhage of the mucous and serous membranes, lymph nodes and subcutaneous tissue.
4. Enlarged spleen.
5. Severe haemorrhagic enteritis.
6. Degeneration of the liver and kidneys.
7. Bloating and rapid decomposition of carcass.
8. Localized lesions in the intestine of pigs (dysentery).

Diagnosis of anthrax is carried out by direct microscopic examination of tissues and fluids.

Judgement: *Condemnation* of the carcass and its parts by burning or burial. If disposed by burial, the carcass should be buried at least 6 feet below ground. The site should be surrounded by a foot thick layer of quicklime.

The carcass must not be opened. Due to insufficient oxygen supply in the closed carcass, spores of *B. anthracis* will not be formed and the organism will be killed. The spilled discharge is firstly removed by drying with sawdust and sand and is then destroyed together with the carcass. The carcass is wrapped in thick plastic sheets and destruction is performed under the supervision of an appropriate government official.

An open carcass facilitates exposure of *B. anthracis* to air and consequently, spores are formed within a few hours. Anthrax spores are resistant to heat and disinfectants and may survive in a suitable environment for years.

The abattoir's pen or stockyard area suspected of being in contact with an anthrax animal should be disinfected with 10 % NaOH or 5 % formaldehyde and cleaned. This cleaning should also include the cattle trucks or cars used for the transportation of infected animals. All personnel that were in contact with anthrax or that handled contaminated material, are also subjected to decontamination. The arms and hands should be washed with liquid soap and hot water. After they have been rinsed, they should be immersed for about one minute, in an organic iodine solution or 1 p.p.m. solution of mercuric perchloride or other acceptable agents. This is followed by a potable water rinse. Clothing of the personnel involved should also be cleaned and thoroughly disinfected by boiling.

If the carcass is discovered on the killing floor, all operations must cease. The carcass and its parts including hides, hooves, viscera and blood must be condemned and destroyed. The carcasses which have been dressed by the same abattoir employees prior to or after the affected carcass must also be condemned and destroyed. Those carcasses which had been dressed before the affected carcass may have a second option of being salvaged with sterilization. They must be boiled for a minimum of 3 hours if contamination occurred with blood splashes. If impractical, these carcasses may be used for "canned meat" for which heat treatment is recommended.

Disinfection of equipment used for the dressing of a diseased carcass as well as the infected abattoir area, should be done with 5 % solution of sodium hydroxide (NaOH). This disinfectant is used because of its action on fat and grease removal. Heat in the form of a blowtorch can be used for disinfecting buildings.

Salmonellosis

Salmonellosis is a disease which occurs in all animals and humans. In animals, salmonellosis is characterized clinically by one of three syndromes: a) *peracute septicemic form*.; b) *acute enteritis* or c) *chronic enteritis*.

Human infection is transmitted via contaminated water, raw milk and meat. Compared to bovines, pigs and poultry are more significant sources of infection in humans.

Antemortem findings:

Peracute septicemic form

1. Occurs most frequently in colostrum deficient animals up to four months of age.
2. Increased temperature 40.4°C – 41.5°C., Depression, Diarrhoea and dehydration.
3. Death within 24–48 hours

Acute enteritis

1. Common form in adult cattle in late pregnancy and early postpartum.
2. High temperature of 40°C – 41°C, Depression and loss of appetite.
3. Watery, foul smelling diarrhoea and dehydration, Emaciation.
4. Reduced milk production and abortion.
5. Death.

Chronic enteritis - Preceded by acute enteric form

Further emaciation (poor doer), diarrhoea and dehydration, Fluctuating fever (35.5°C – 40.0°C)

Postmortem findings:

Septicemic form:

1. Absence of gross lesions in animals.
2. Submucosal and subserosal haemorrhage.

Acute enteritis:

3. Mucoenteritis to diffuse haemorrhagic enteritis.
4. Severe necrotic enteritis of ileum and large intestine caused by *S. typhimurium*.
5. Abomasitis in *S. dublin* infection.
6. Enlarged, edematous and haemorrhagic lymph nodes.
7. Thickened inflamed gall bladder wall.
8. Fatty change of the enlarged liver.
9. Subserous and epicardial haemorrhage.

Chronic enteritis

10. Areas of necrosis in the wall of caecum and colon.
11. Swollen mesenteric lymph nodes and spleen.
12. Chronic pneumonia.

In the septicemic and acute enteric forms, *Salmonella organisms* are present in the blood, liver, bile, spleen, mesenteric lymph nodes and in intestinal content. In the chronic form, bacteria is present in the intestinal lesions and less frequently in other viscera.

Judgement: Carcass affected with Salmonellosis is *condemned*.

Haemorrhagic septicemia

Haemorrhagic septicemia is a systemic disease of cattle, buffalo, pigs, yaks and camels. It is caused by *Pasteurella multocida* type B of Carter. Outbreaks of this disease are associated with environmental stresses such as wet chilly weather and overworked, exhausted animals. It is specific type of pasteurellosis distinct from other forms of pasteurella infections.

Transmission: By ingestion of contaminated feedstuff.

Antemortem findings:

1. Disease more severe in buffalo than in cattle.
2. High fever up to 42°C.
3. Salivation and difficulties in swallowing.
4. Cough, and difficult breathing and associated pneumonia in later stages.
5. Edematous swelling of throat, dewlap, brisket and peritoneum.
6. Diarrhoea.

Postmortem findings:

1. Subcutaneous swellings characterized with yellowish gelatinous fluid especially around the throat region, brisket and perineum.
2. Enlarged haemorrhagic lymph nodes.
3. Haemorrhage in the organs.
4. Pneumonia.
5. Rarely haemorrhagic gastroenteritis.
6. Petechial haemorrhage in the serous membranes which are extensive in some cases.

Judgement: Carcass of an animal affected with haemorrhagic septicemia is *condemned*. If the disease is diagnosed on antemortem examination, an animal should not be allowed to enter the abattoir. Dressing of such a carcass would create potential danger for the spread of infection to other carcasses.

Differential diagnosis: Anthrax, blackleg, acute leptospirosis, rinderpest, other pasteurellosis, snake bite and lightning stroke.

Actinobacillosis

Actinobacillosis is a chronic disease of cattle caused by *Actinobacillus lignieresii*. It is manifested by inflammation of the tongue and less frequently lymph nodes of the head and of even the viscera and carcass.

Antemortem findings:

Loss of appetite, Salivation and chewing, Swollen tongue, Mouth erosions, Enlarged parotid and retropharyngeal lymph nodes

Postmortem findings:

1. Enlarged tongue showing tough fibrous consistency. ("wooden tongue").
2. A cluster of small yellowish nodules and erosions of tongue mucosa.
3. Granulomatous lesions in the lymph nodes. .
4. Marked thickening of the lower part of oesophagus and stomach wall.
5. Raised plaques and erosions in the mucosa of rumen and reticulum.
6. Liver and diaphragm lesions due to contact spread from reticulum.

Typical actinobacillosis lesions in the lymph nodes and organs consist of greenish-yellow thick creamy pus with "sulphur granules". These are bacterial colonies surrounded by club like structures

Judgement: Carcass of an animal affected with active progressive inflammatory lesions of actinobacillosis in lymph nodes and lung parenchyma is *condemned*. Condemned material should be sent to authorized rendering plant. If the disease is slight and confined to lymph nodes, the head and tongue and whole carcass are *approved* after the condemnation of lymph nodes. If the tongue is diseased and no lymph nodes are involved the head and carcass are *approved*. The tongue is *condemned*.

Differential diagnosis: Neoplasms, tuberculosis, abscesses in the lymph nodes, foreign body, salivary cysts, fungal granulomas, chronic pneumonia and parasites

Actinomycosis ("Lumpy Jaw")

Actinomycosis is a chronic granulomatous disease of cattle and pigs and rarely in sheep and horses. It is caused by *Actinomyces bovis* which is an obligatory parasite in the mucous membrane of the mouth and pharynx. Infection occurs following injury with a sharp object or hard feed pieces to the oral mucosa.

Antemortem findings:

1. Painful swelling of the maxilla and mandible (lumpy jaw); rarely in feet.
2. Suppurative tracts in the granulation tissue breaking towards oral cavity or skin.
3. Ulceration of cheeks and gums and wart like granulations outward on head.
4. Difficult breathing and salivation, Loss of weight , Diarrhoea and bloat.

Postmortem findings:

1. Lesions in the mandible (Lumpy jaw) or maxilla.
2. Granulomatous lesions in lower part oesophagus or anterior part of the reticulum.
3. Local peritonitis, Mild abomasitis and enteritis.

Judgement: see Actinobacillosis

Mastitis

Mastitis is inflammation of the udder caused by *bacteria, fungi and yeasts*. Depending on the virulence of the agent and resistance of the udder, mastitis is manifested in acute or chronic forms.

Antemortem findings :

1. Variable temperature depending on stage of condition.
2. Swollen warm, painful udder or hard enlargement involving one or all quarters.
3. Depression, loss of appetite and dehydration.
4. Abnormal gait caused by rubbing of the hind leg against inflamed quarter.
5. Animal tends to lie down
6. Purulent or bloody exudate from teats or watery pale fluid in chronic cases.

Postmortem findings :

1. Pale yellow granular appearance of the udder parenchyma.
2. Light brown edematous udder parenchyma .
3. Enlarged supramammary, iliac and lumbar lymph nodes.
4. Injection sites.

Judgement : Carcass and viscera are *condemned* if acute or gangrenous mastitis is associated with systemic changes. If infection has spread from the supramammary lymph nodes via the iliac lymph nodes to the lumbar lymph nodes, this can be taken as evidence of spread of infection from its primary location. The condemnation of the carcass may then be warranted. A localized condition of the udder has a *favourable judgement* of the carcass.

PARASITIC DISEASES

LUNG WORMS:

Dictyocaulus viviparus is a lung worm in cattle causing verminous pneumonia or bronchitis, husk or hoose.

Ante mortem findings:

1. Elevated temperature (40 - 41 °C)
2. Rapid shallow breathing which in later stages becomes laboured breathing
3. Nasal discharge, 4. Grunting, 5. Cyanosis and recumbence.

Post mortem findings:

1. Hemorrhagic inflammation of bronchi with froth, 2. Lung edema and emphysema
3. Consolidation of lung parenchyma, 4. Lung worms, 5. Enlarged lung lymph nodes

Judgment: Carcass of animal affected with lung worms is *approved* if infestation is slight and no secondary changes are observed. The lungs are *condemned*. The carcass is *condemned* if lung worm infestation has caused pneumonia which is accompanied with emaciation or anemia.

FASCIOLIASIS:

Fascioliasis is caused by different liver flukes. *Fasciola hepatica* is the most widespread in distribution.

Fasciola gigantica in Africa and some parts of South East Asia.

Ante mortem findings:

1. Weight loss and emaciation, 2. Fall in milk production, 3. Anemia, 4. Chronic diarrhea
5. Swelling in the mandible area

Postmortem findings:

1. Emaciated, anemic or edematous carcass in severe chronic infestations
2. Presence of flukes in enlarged and thickened bile ducts and in the liver parenchyma
3. Hepatic abscesses and secondary bacterial infection, 4. Calcification of bile ducts
5. Black parasitic material (excrement) in the liver, lungs, diaphragm and peritoneum
6. Hemorrhagic tracts of migratory immature flukes in the lungs and liver in an acute infestation
7. Black lymph nodes of the lungs and liver due to fluke excrement, 8. Icterus due to liver damage.

Judgment: Judgment depends on the extent of the fluke lesions and the condition of the carcass. Severe infestation with associated emaciation or edema would necessitate *total condemnation* of the carcass. Mild, moderate and heavy infestation without emaciation may have a *favorable judgment*. If the parasitic lesions in the liver are clearly circumscribed, the liver *may be salvaged* after trimming of affected tissue. Otherwise it is *condemned*.

OESOPHAGOSTOMIASIS (Pimply gut, Nodular worms)

Oesophagostomiasis is a parasitic disease of ruminants and swine. *Oesophagostomum radiatum* is found in cattle, *Oesophagostomum Columbiana* in sheep and *Oesophagostomum dentate* in swine.

Ante mortem findings:

1. Diarrhea with black-green faeces which may be mixed with mucus and blood
2. Loss of condition and emaciation, 3. Stiff gait, 4. Young calves may show loss of appetite, diarrhea, emaciation and anemia.

Postmortem findings:

1. Grayish white nodules ranging in size from a pinhead to a pea. The nodules may contain a greenish pasty material in younger lesions or a yellow - brown crumbly material in older lesions.
2. Thickening of the intestinal wall,
3. Local peritonitis,
4. Mild inflammation of intestine in the acute stage,
5. Chronic inflammation of colon in the chronic stage

Judgment: Intestines affected with nodular worms are *condemned*. The carcass is also *condemned*, if severe infestation of this parasite is associated with emaciation and edema. Mild, moderate and heavy infestation without emaciation may have a *favorable judgment*. However, intestines should always be condemned as they cannot be used for sausage manufacture.

CYSTICERCIDS

Bovine cysticercoids are caused by *Cysticercus bovis*, which is the cystic form of the human tapeworm *Tania saginata*. Infection in man occurs following consumption of raw or undercooked beef containing viable cisticerci. Cattle become infected by ingestion of feedstuff containing ova passed from infected humans.

Ante mortem findings:

Heavy infestation in cattle may show muscle stiffness and rarely fever.

Postmortem findings:

1. Small white lesions (cysticercoids 2 – 3 weeks after infection) in muscle tissue
2. Clear transparent bladders 5 × 10 mm (infective cysticercoids, 12 – 15 weeks after infection,
3. Opaque and pearl like (over 15 weeks of infection)
4. Degeneration, caseation and calcification (after 12 months or more after infection)
5. Degenerative myocarditis

Judgment: Carcass and viscera of an infested animal should be differentiated with those with “heavy” infestation and those with “light” infestation. Carcass and viscera of heavily infested animals are *condemned* and those with light infestation should be treated either by *boiling* or *freezing*. The extent of “heavy infestation” is prescribed by the controlling authority. An animal is commonly considered heavily infected, if lesions are discovered in two of the usual inspection sites including the masseter muscles, tongue, esophagus, heart, diaphragm or exposed musculature and in two sites during incisions into the shoulder and into the rounds.

HYDATID DISEASE (Hydatidosis, Echinococcosis)

Hydatid disease in cattle is caused by the larval stages of the 2–7 mm long tape worm *Echinococcus granulose*, which lives in the intestines of dogs and other carnivores. Several strains of *E. granulose* exist; the cattle/dog strain is primarily responsible for hydatid disease in cattle.

Ante mortem findings:

Careful palpation reveals sub-cutaneous nodules in the brisket and buttock regions.

Postmortem findings:

1. Firm fibrous nodules (0.5 cm - 5 cm in diameter) singly or in clusters in the regions of brisket, buttocks and thighs.
2. The nodules have tightly coiled worms.
3. The worms may be dead or calcified in older nodules.

Judgment: The affected carcasses can be *passed* after the nodules have been *removed*. In heavy infestations the affected briskets are removed, and the tissue and the fascia around the stifle and the brisket are stripped off before the carcasses are passed.

DISEASES CAUSED BY PROTOZOA**TRYPANOSOMIASIS**

This is a protozoan disease of animals and humans caused by parasites of the genus *Trypanosoma*, which are found in blood plasma, various body tissues and fluids.

Ante mortem findings:

1. Intermittent fever,
 2. Anemia,
 3. Weight loss and weakness,
 4. Edema, particularly observed in the face and legs,
 5. Enlarged body lymph nodes,
 6. Hemorrhage,
 7. Opacity of the cornea, keratitis and photophobia.
- Chronic form of trypanosomiasis is sometimes manifested by progressive weakness, despite absent parasitemia, and death.

Postmortem findings:

1. Enlarged lymph nodes, 2. The enlargement of spleen, liver and kidney may also occur.
3. Edematous and emaciated carcass, 4. Mild icterus

Judgment: The carcass affected with trypanosomiasis or any other protozoan diseases is *condemned* if an acute condition is associated with systemic body changes. Heat treatment may be recommended in some cases if economically feasible. The carcass of recovered and reactor animals may be *approved* if generalized lesions are lacking. Carcass showing borderline emaciation or slight edema should be examined after the 24 - 48 hours in the chiller. A satisfactory setting would lead to a *favorable judgment* of the carcass. The affected parts of the carcass and organs are *condemned*.

THEILERIOSIS (East coast fever)

East coast fever is a sub acute haemoprotozoan disease of cattle caused by *Theileria parva*. Theileriosis is characterized by fever, enlarged lymph nodes, dyspnea and death. In chronic cases loss of condition, emaciation, diarrhea, blindness, etc. can be seen.

Ante mortem findings:

1. Mortality up to 90 %, 2. High temperature (up to 41 °C), 3. Difficult breathing and coughing
4. Nasal discharge, salivation and watery eyes, 5. Swelling of the lymph nodes draining the area where the infected tick fed, 6. Cerebral signs manifested by circling to one side, convulsions and death

Postmortem findings:

1. Froth in nostrils and bronchi associated with pulmonary edema and emphysema, 2. Swollen, edematous lungs and interstitial pneumonia, 3. Enlarged and hemorrhagic lymph nodes and splenic lymphoid hypertrophy, 4. Enlarged and mottled liver, 5. Infarcts, thrombosis and lymphoid hypertrophy in spleen, 6. White spots of lymphoid aggregates in a kidneys, 7. Brownish coloration of fat, 8. Hemorrhagic and rarely ulcerative enteritis.

Confirmation of diagnosis is only made through detection of parasites in a Giemsa stained lymph node biopsy smear and/or blood smear.

Judgment: Carcass and viscera of an animal affected with febrile chronic theileriosis and without systemic lesions are *approved*. Carcass is *condemned*, if acute febrile theileriosis is accompanied with fever and generalized lesions. The affected organs are also *condemned*.

BABESIOSIS (Piroplasmosis, Texas fever, Red water fever, Tick fever)

Babesiosis of cattle, horses, sheep and swine is a febrile, tick borne disease caused by various species of the protozoan genus *Babesia*.

Ante mortem findings:

1. Incubation 7–10 days, 2. Mortality up to 50 % or over depending on age, breed, etc.
3. High fever (41.5° C), 4. Dark reddish brown urine in the terminal stage, 5. Reddened and injected mucous membranes at the early stages and later, anemic mucous membranes, 6. Clinical signs may resemble rabies in cerebral form of babesiosis.

Postmortem findings:

1. Edema and congested lungs, 2. Enlarged and yellow liver and distended gall bladder with thick dark green bile. 3. Enlarged spleen. 4. Anemia and pale muscles, 5. Jaundice particularly noted in the connective tissue, 6. Edematous and hemorrhagic lymph nodes, 7. Yellowish-orange color of musculature (mild cases), 8. Occasionally dark kidneys with no other findings, 9. Pink hemorrhage of a bovine brain,

Diagnosis can only be confirmed by identification of parasite in the peripheral blood smear stained with Giemsa

Judgment: Carcass of an animal in acute form of the disease, with associated icterus, is *condemned*.

An emaciated, jaundiced carcass showing yellow gelatinous fat also requires total condemnation. A mild form of this disease showing yellow orange coloration of carcass not associated with icterus may be *approved*. The satisfactory setting of the carcass in the chiller must be considered in this approval.

SARCOCYSTOSIS (Sarcosporidiosis)

Sarcocystosis is caused by the various species of the protozoan genus *Sarcocystis*. This is one of the most common parasitic conditions in domestic food animals and a high percentage of cattle in various parts of the world are infested with these parasites which are usually host specific. In cattle three species have been recognized. They are *S. cruzi*, *S. hirsute* and *S. hominis*. Cattle are the intermediate

hosts of Sarcocystis spp. All Sarcocystis spp. in the intermediate hosts, the food animals, are characterized by the formation of cysts in the muscles.

Table 1: Sarcocystis spp. in Cattle

Species	Distribution	Definitive Host/s	Size of cyst	Pathogenicity
S. cruzi	World-wide	Dog, coyote, red fox, racoon and wolf	Microscopic, less than 0.5mm long.	Most pathogenic species in cattle it can cause fever, anemia, abortion neurological signs and even death.
S. hirsuta	Probably worldwide	Cat	Macroscopic, up to 8mm long and 1mm wide, fusiform in shape	Mildly pathogenic
S. hominis	Europe	Humans and some primates	Microscopic	Mildly pathogenic to cattle

Transmission: Cattle acquire infection by ingesting sporocysts contaminating feed, pasture or water. The definitive host, including humans acquires the infection when they eat bovine tissues containing the viable Sarcocystis cysts.

Ante mortem findings:

- 1. Incubation period 5 - 11 weeks, 2. Fever, 3. Loss of appetite, 4. Excessive salivation, 5. Anemia, 6. Abortion, 7. Loss of hair especially at the tip of the tail

Postmortem findings:

- 1. The cysts are microscopic and therefore are not detected on routine postmortem inspection. They cause little tissue reaction., 2. In some cases the cysts may be associated with eosinophilic myositis, 3. A histological section of bovine muscle affected with eosinophilic myositis showing massive accumulation of eosinophiles and two micro cysts of S. cruzi, 4. S. hirsuta cysts may be seen as fusiform objects 8 mm × 1 mm in the esophagus, diaphragm and skeletal muscles of older animals especially bulls. 5. Macroscopic cysts of S. fusiformis in the skeletal muscle of buffalo.

Judgment: Judgment should be made on macroscopic presence of cysts. In heavy and widespread infestations with the visible cysts the whole carcass is condemned. In lighter infestations those parts of the carcass which are not affected are passed for human consumption. Microscopic examination of muscle may show as much as 70 % infestation in animals worldwide.
