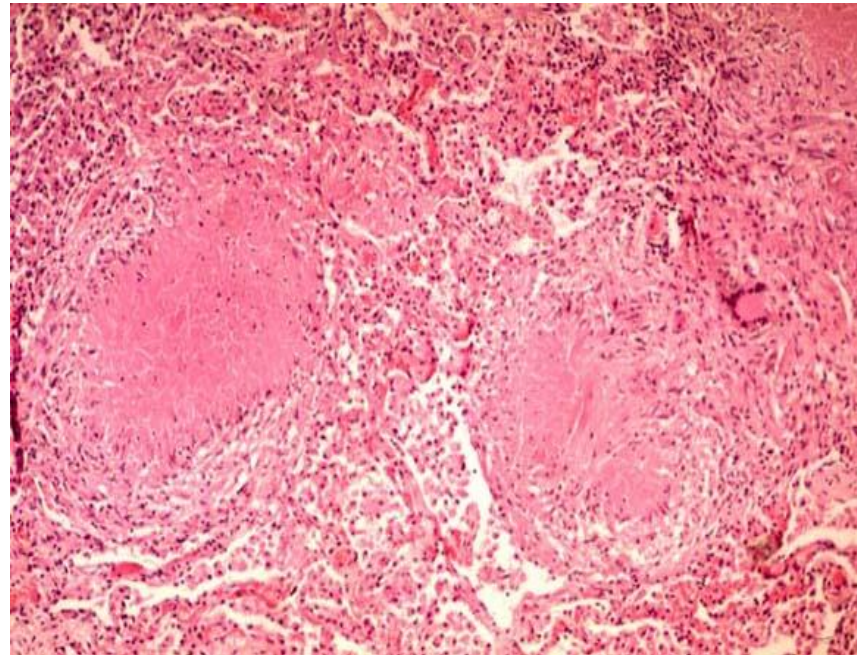


**M.J.F. COLLEGE OF VETERINARY AND ANIMAL SCIENCE,
CHOMU, JAIPUR**

DEPARTMENT OF VETERINARY PATHOLOGY



Etiology

Study of causes of disease

Disease- caused by single agent (Unifactorial)

Several agents (Multifactorial)

either simultaneously or in succession

Intrinsic - Originate within the body - Internal- Endogenous-
Predisposing- Genetic

Extrinsic- Come from outside the individual- External- Exogenous-
Exciting-Environmental

Interaction between inherent mechanism and assorting influence
determines the disease

Extrinsic causes

Physical Causes

Biological Causes

Chemical Causes

Nutritional Causes

PHYSICAL CAUSES

Injury caused by physical agents may be

1. Physical influences like-Mechanical trauma, pressure, obstruction, mal positions
2. Thermal injury- excess heat, excess cold
3. Injury due to light- sun burn, photosensitisation
4. Electrical injury- Low and high voltage current
5. Injury due to change in atmospheric pressure
6. Injury due to Ionizing radiation

Mechanical Trauma

Most common cause of Mechanical injury are automobile accidents, gunshot wounds, cutting by wire, knife, blades etc.

Injury depend upon shape of striking object, the amount of energy applied and type of tissue or organ that bear energy impact.

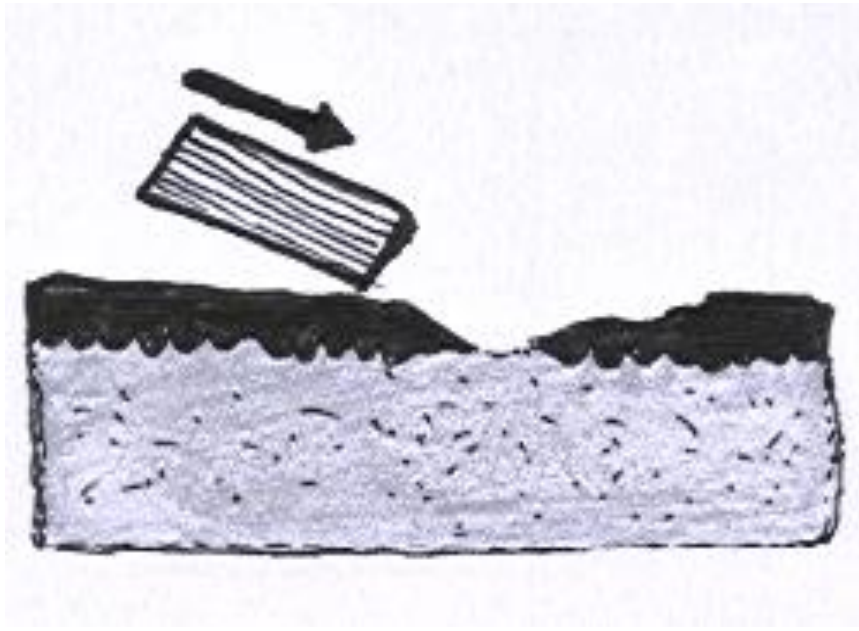
If large vessels cut severe haemorrhage occur which may cause death

If local internal injury, blood may collect in internal hollow organs or body cavity

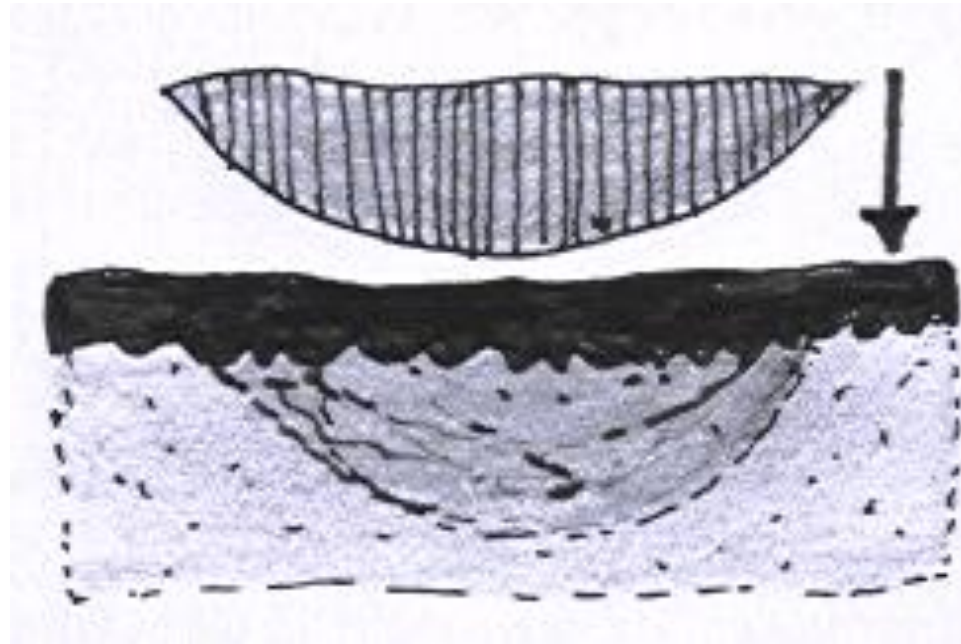
Bacterial infection at the site is common complication

The pattern of injury may be as

Abrasion : Injury of a rubbing or scrapping nature resulting in removal of superficial layer



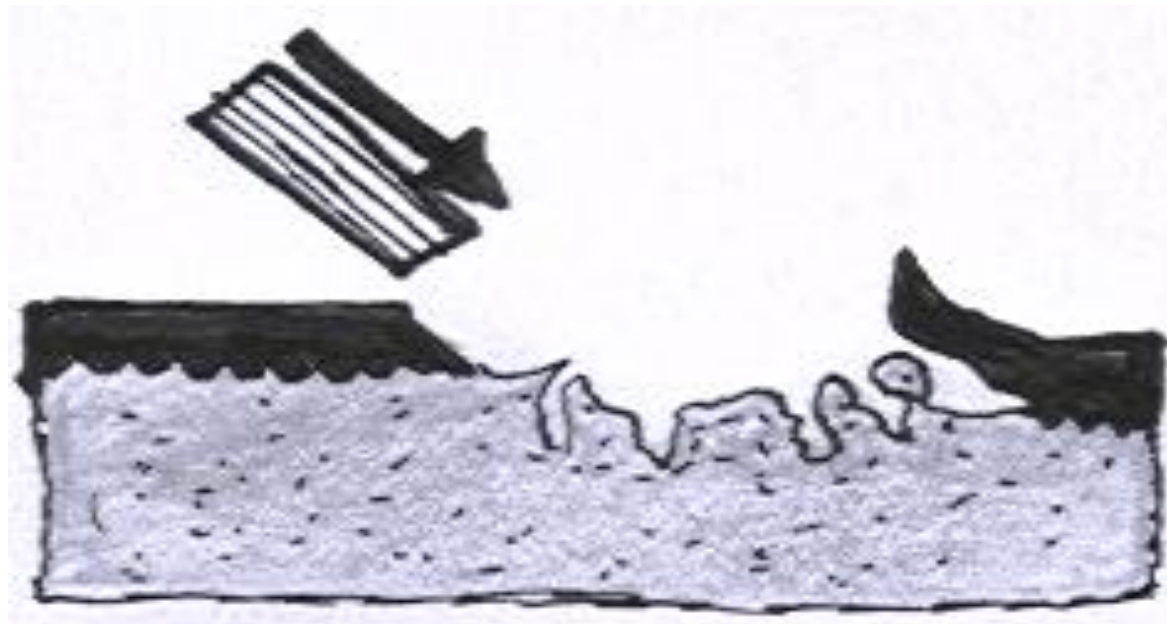
Contusion or Bruise : wound caused by blunt object. The skin is not broken but underlying tissues are damaged. It cause damage to the blood vessels and escape of blood in the tissues.



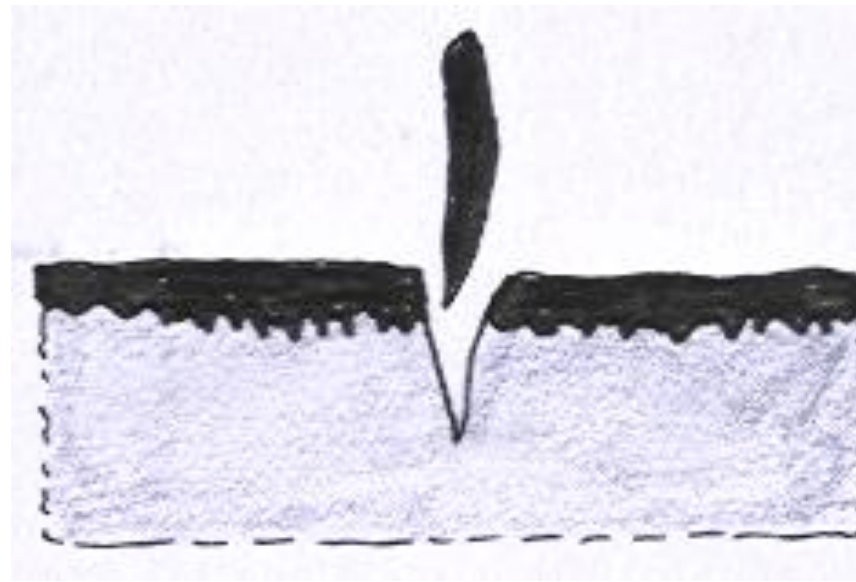
Laceration: Wound characterized by tearing or disruptive stretching of the tissues caused by a force of blunt object.

eg. Wirecuts on legs, automobile accidents.

This has irregular ends and intact bridging vessels



Incised wound: Long, narrow clean wound produced by a sharp object such as knife. Tissue damage is minimal but bridging vessels are cut



Puncture or Penetrating wound:

Wound caused by long narrow instrument.

It is penetrating when instrument is piercing the tissue.

It is perforating when instrument is passes through the tissue and creates an exit wound. eg. Wound caused by bullet or a nail. Usually infected by anaerobes

Concussion: Usually applied to injuries of CNS (Brain). Violent shock leading to functional disturbances of CNS may or may not be associated with loss of consciousness.

Rupture: Injury in which tissues are stretched until the fibers break.

Fracture: Injury to the bone, cartilage, tooth, hoof, horn, or claw in which continuity of the hard structure is broken.

Sprain: Injury to the joint in which supporting ligaments, tendons, muscles around joint have been stretched or slightly torn. (Anatomical relationship is maintained)

Luxation or Dislocation: Injury to the joint in which ligaments supporting the joint are torn. (Anatomical relationship is not maintained)

Injury due to physical pressure

Pressure injury by physical force over a considerable time - leads to pressure atrophy of involved organ seen near tumor, cyst, abscess etc.

This also cause injury like bed sores in recumbent animals because of pressure against hard floor or hard bedding.

Injury due to obstruction

Obstruction of hollow organs by foreign bodies such as concretions- Hair ball in intestine, calculi in ureters

Parasites- lung worm in bronchi, roundworm and tapeworm in intestine and bile ducts

Physical objects like rubber ball in stomach or broken urinary catheter,

Aspirates in the respiratory passage (feed, water, medication)

Normal flow of the fluid through the part is prevented

Leads to stenosis of lumen of affected organ

Subsequent inflammation and contraction of scar tissue leads to stricture formation.

Injuries due to Mal position

Through physical influences the position of the organs or part of the body may become displaced.

Tortion- Twisting of an organ upon itself occur in intestine or uterus

Volvulus- Rotation of small intestine around its mesenteric attachment

Intussusception- Telescoping or Invagination of one portion of intestine in to immediately posterior portion of it

Prolapse- Appearance of organ or portion of a organ at a natural or artificial body opening

Eversion- When rectum turns inside out and protudes through anus (Vulva through vagina) is called eversion

Eventration- Protrusion of intestine or other visceral organ through tear in ventral abdominal wall

Hernia- Protusion of an organ or part of an organ through wall of the cavity, which normally contain it. Inguinal, Scrotal, Umbilical, Diaphragmatic etc.

Thermal injury-Excess heat and Excess cold

Excess heat: Injury depend upon Intensity and duration & percentage of total body surface involved.

Excessive application of heat- thermal burn.

Excessive retention of heat- Heat stroke-associated with high ambient temp, high humidity-body thermoregulatory mechanism fails, sweating ceases and core body temp rises.

In humans - with increase in environ. temp, body temp. and rate of breathing are little affected while pulse rate are increased. Heat -dissipating mechanism through skin is most efficient.

In Animals - with increase in environ. temp there is rise in body temp. and pulse rate is little affected. They depend on cooling by evaporation from respi. tract. To increase heat loss they resort to panting. Ventilation from tongue increases the rate of evaporation.

Blood flow from tongue of dog increases six times during hyperthermia.

Thermal burns-

surface burns
inhalation burn injuries

Surface burns: Size and depth of burn are imp.

Any burn exceeding 50% of total body surface whether superficial or deep is grave; above 70% is often fatal. Shock is most life threatening complication.

According to depth of burn

1. Full thickness burn: Total destruction of entire skin with loss of dermal appendages and extend deep in to underlying muscles, viscera and even bone. (III rd & IV th degree burns)
2. Partial thickness burn: Low intensity burn in which there is involvement of epidermis and superficial dermis. Deeper portion of dermal appendages are not involved. (First & second degree burns). In this the burn appears reddened as small blood vessels dilate and later on there is formation of burn blister because of increased vascular permeability and exudation of protein rich fluid.

Ist degree burn-Reddening of skin due to hyperemia and erythema and mild inflam.reaction. This is followed by slight peeling of superficial layer of skin

IInd degree burn- Formation of burn blister. There is destruction (coagulative necrosis)of epidermis and superficial dermis with inflammation. Complete recovery is possible.

IIIrd degree burn-There is complete necrosis and inflam. of epidermis and underlying dermis. The dead tissue sloughs and heals slowly by granulation tissue leaving scar formation.

IVth degree bur burn-There is complete necrosis, charring and blackening of epidermis and underlying dermis, muscles, viscera and bones. No recovery occurs.

Inhalation burn injury

Animals trapped in fire who inhale heated air and noxious gases in the smoke develop inhalation injury at any level in respi.tract from nose or mouth to lungs.

Water soluble gases such as chlorine, ammonia & SO₂ react with water to form acids or alkalies particularly in upper respi.tract and produce inflam. & swelling.

Lipid soluble gases like NO₂ and products of burning plastics may reach deep in to lungs and produce pulmonary edema and bronchopneumonia from secondary infection.

Excess cold

Prolonged effect of low temp depend upon whole body exposure or part of the body.

Prolonged exposure to low ambient temp. to whole body result in death without causing necrosis of cells as the systemic homoeothermic mechanisms fails due to hypothermia

Local effects- Chilling or freezing of cells or tissues cause direct effect as water within the cell or outside the cells undergo crystallization. This result in high salt conc. with in the cells or physical dislocation of cells by ice crystals.

Indirect effect as chilling cause vasoconstriction and increase vascular permeability with edematous changes. This in turn cause ischemic injury with coagulative necrosis of affected area. The area is sharply demarcated from healthy tissue The tissue may become dehydrated and may invade by saprophytic bacteria (gangrene) Frost bite is confined to extremities.

Injuries due to light

Sun burn: Unusual reaction of unprotected skin by absorption of UV rays shorter than 320 μm . Domestic animals do not suffer as they have heavily pigmented skin and covered with hair, wool, feathers that protect from sunrays.

Photosensitization or light sickness: Unusual reaction of unprotected skin of domestic animals by absorption of UV rays betn. 540-600 μm . This is because absorption of certain wave length of sun light by photodynamic pigment / agent present in the skin. This results in necrosis and oedema of exposed tissues especially of hairless skin usually teats, udder, ears, eyelids, lips coronets in sheep etc.

1. Primary photosensitization
2. Photosensitization from abnormal porphyrin metabolism
3. Hepatogenous photosensitization

Primary photo sensitization : Due to ingestion of preformed photodynamic agents present in lush green or rapidly growing plants. When animals are grazed on such plants the pigments are absorbed in the blood and deposited in the tissues. Administration of agents like phenothiazine, sulphonamides, tetracycline also cause primary photo sensitization.

Photosensitization from abnormal porphyrin metabolism: Porphyrins are pigments present in Hb. In congenital porphyria there is excessive production of uroporphyrin and coproporphyrin in the body and are photodynamic. Uroporphyrin is deposited in bones (osteohaemochromatosis) and teeth (pink tooth).

Hepatogenous photosensitization : Due to hepatic disease which interferes with normal excretion of phylloerythrin in the bile which is normal end product of chlorophyll metabolism present in ingested plants. This accumulates in the body and also in skin in hepatic disease and act as photodynamic agent and make the skin susceptible to light. This is common in animals grazing on green pasture or plants containing hepatotoxins or poisons like CCl₄ or diseases like leptospirosis

Electrical injury

Can arise from low or high voltage current when animal come in contact with high tension wires during wind or storm

Also arise from lightening in which there are lightening marks or figures either tree shaped, branching or reddish blue streaks on the skin.

Severe electric shock usually cause death - Electrocution. If the current is continuously applied the muscles gradually relax and animal dies with in a minute. At the site of current the skin & s/c tissue show deep **burns**.

General effects are pinpoint hemo. on the serous mem. of internal organs, blood is black & liquefied and blood vessels are severely injured. Surviving animal develop pulmonary edema and hypertrophy of right ventricle.

Death is due to **cardiac and respi. failure**

Change in atmospheric pressure

Decrease atmospheric pressure can cause-Brisket disease in animals grazed at high altitude

At high altitude- low atmospheric pressure- low O₂ -state of partial hypoxia- O₂ supply to the tissues is less- polycythemia develops which increase the viscosity of blood- hypoxia puts pressure on heart-Hypertrophy of heart- CVC develops-dilation of blood vessels-edematous fluid accumulates at brisket region due to influence of gravity

Increase atmospheric pressure cause - caisson disease where there is formation of gas or air emboli in the circulation.

Caisson is compartment created in water for construction workers. Here the air pressure is raised several times than normal atmospheric pressure so that the person can work in this compartment under the water.

At this high pressure air enters in the blood from lung is dissolved in greater amount than on the land but when worker comes on the surface, the dissolved gas liberate quickly because of sudden release of pressure and gas like nitrogen form emboli in the blood . This cause severe cramping pain

Injury by Ionizing radiation

occur in two forms

- Electromagnetic waves (X-rays, gamma rays)

- High energy neutrons and charged particles (alpha & beta particles & protons)

They cause direct damage to DNA of cells or indirect damage to DNA by inducing formation of free radicals that formed from hydrolysis of water.

Absorbed radiant energy leads to radiolysis of cell water to form H and OH free radicals which initiate chain of reactions to cause injury and death of cells.

Rapidly dividing cells like bone marrow, lymphoid tissue, mucosa of GI tract are more vulnerable to radiation as DNA is primarily targeted

Tissues with slow turnover like liver are not immediately affected but gradually depopulated

Tissues with non dividing cells like brain and cardiac muscles do not show radiation except at very high doses

Rate of delivery modifies the effect of radiation. Delivery in divided doses allow cells to repair some of the damage in intervals.

Hematopoietic and lymphoid systems are extremely susceptible to radiant injury. At high doses lymphopaenia may occur along with shrinkage of lymph node and spleen.

Radiation directly destroys lymphocytes in circulating blood and tissues.

Erythrocytes are radio resistant even then anemia results after 2-3 wks and persists for months.

Gonads both in male and female-germ cells are vulnerable.

Another imp. effect is malignant transformation

Total body irradiation i.e. exposure of larger body area induce acute radiation syndrome with above listed effects.

Injury by chemical agents

All chemicals including therapeutic agents are capable of causing injury or even death. Most toxic chemicals are poisons occur mostly accidentally when animal ingest poisonous substances. Criminal poisoning also occur and of medico legal imp. Chemical injury depend upon

Dose-higher the dose more the toxicity; Small dose for longer period are also serious

Some chemicals require metabolic conversion to exert their toxic effect e.g.. Alcohol

Site of absorption, accumulation and excretion are targets of maximum injury

Individual variation

Capacity of chemical to induce immune response eg. Penicillin induce Ig E mediated anaphylactic immune response or Ig E mediated hemolytic anemia in persons genetically prone to develop type I hypersensitivity reaction to this drug.

Chemical poisons

Are either organic or inorganic substances

Inorganic poisons- acids, bases, heavy metals(Ar,Hg,P) and salts

Organic poisons are derived from plants, moulds, fungi and bacteria. eg.
Insecticides, pesticides, fungicides, rodenticides

These toxic agent may exert a corrosive effect or caustic action or act as organ poison or nerve poison or alter the blood

Corrosives : caustic alkalines - NaOH, KOH, CaO. BaCl₂; corrosive salts of heavy metals- ZnSO₄, HgCl₂; corrosive acids- Nitric, acetic, oxalic, carbolic, sulphuric

These substances produce burns that vary in intensity from hyperemia to severe inflam to necrosis and ulceration depending upon quantity, conc. and place of contact.

Organ poisons-produce deg. Changes in organs like liver, kidney and heart e.g. phosphorus ,arsenic, lead, silver nitrate, mercuric chloride

Nerve poisons- depress or paralyze the nerve cells- narcotics, strychnine, atropine, pilicarpine, snake venoms, Cl tetani, Cl botulinum etc.

Poisons affecting the blood : Prevent O₂ carrying capacity of RBCs. eg. Carbon monoxide- poison that combine with Hb. It acts as a systemic asphyxiant. It has 200 fold greater affinity for CO than oxygen. The carboxy Hb formed is incapable of carrying oxygen. This results in systemic hypoxia, unconsciousness and death

Cattle & sheep may suffer from lead poisoning by licking lead from freshly painted surfaces or water or food containing lead is consumed. Lead is absorbed through GI tract and most is taken up by bone(80-85%) and remainder is accumulated in blood and soft tissues. Clinically black lead line develop on the gum due to hyper pigmentation- Plumbism. Kidney damage also occur as it excretes through it.

Cattle may also suffer from flourine poisoning-fluorosis from raw rock phosphate as mineral supplement.

Sheep also suffer from copper poisoning with treatment of stomach worm.

Insecticides both chlorinated hydrocarbons-DDT, Aldrin, Lindane: and organophosphorous compounds-malathion and parathion are harmful to animals. They contaminate food chain. DDT has been found in fruits, vegetables, milk, meat.

Chlorinated hydrocarbons affect the CNS and induce depression, paralysis, coma and death.

Organophosphorus compounds are basically inhibitors of acetyl cholinesterase. The acetylcholine accumulates at synaptic junctions causing muscle twitching, flaccid paralysis cardiac arrhythmias, respi depression and death.

Biological causes:

- Biological agents that cause infectious dis. vary in size from 23 nm(FMD virus) to 33 ft long tape worm.
- Bact,, viruses, fungi, mycoplasma, rickettsiae, spirochate, mycobact , parasites (Protozoa, metazoa - endoparasites (helminths, trematodes,cystodes and ecto parasites-like mites ,lice, ticks
- Prions- recent addition to the class of infectious agent- lack nucleic acid and do not produce inflam. or immune reaction-cause diseases known as TSEs

Intrinsic-internal causes

- Causes on which individual has no control, come from within the body. they are
 1. Genetic and inherited cause-transmitted to offspring through germ plasm (gametes). This are due to mutation in genes i.e. permanent damage in DNA. They may be
 - a. Lethal characters- cause death of animal in utero or after birth. eg Parrot beak in cattle, Atresia ani in horse.
 - b. Sub lethal characters-interfere with function, do not cause death .eg Infertility in cattle, deafness in white cats, scrotal hernia in pigs.
 - c. Defects that are inherited errors in structure and function.eg Cryptorchidism, webbed digits

2. Genetic and non inherited causes- not transmitted to offspring through germ plasm. Lead to disturbance in development like anomalies, monster or serious deviation from normal type

A. Anomalies: Developmental defect that affect organ or part of organ.

1. Due to arrest in development. eg aplasia or agenesis, hypoplasia, atresia, may be congenital

2. Fusion of paired organ like kidney, cyclopia-only one eye in the middle of forehead

3. Excess of development -polydactylia, polymastia

4. Displacement of organs- ectopiacardis, dextrocardia

5. Fissures on median line- cleft palate, cranioschisis.

6. Persistence of fetal structures -foraman ovale, pervious urachus

7. Fusion of sexual characters-

Free martin - Female calf in a set of male & female twins having arrested development of sex organs. Due to placental anaestomosis male reproductive cells invade in to female

Hermaphrodite: Animal having both ovarian and testicular tissue. The testis and ovary may be mixed (ovotestis) or separate. (Both male & female genitalia-XX & XY karyotype).

Pseudohermaphrodite: Animal which has gonads of one sex either ovary or testis but external genitalia of opposite sex. eg. Male has male gonads and female external genitalia.

Monster: is a malformed foetus with excessive abnormal development. They do not survive if born live. They develop from a single ovum.

Other intrinsic causes

Genus: Swine fever-Pig; C.D.-Dog; Man is immune to RP.

Breed: Dairy cattle breeds are more susceptible to diseases than beef cattle

Bulldog breeds-more prone to brain tumours. German shepherd & Greatdanes to bone dis.

Age: Certain disease are found in definite age group. CD-young dog, Strangle-young horse, Caecal cocci-young chick, cancer-old age

Sex: Mastitis, metritis, milk fever-Female: Males-night blindness and nephritis (dog). Reprod. Dis are more commom in females.

Color: Malig. Melanoma common in white & grey horses.

Iatrogenic cause

- Causation of disease with respect to physician.
Due to indiscriminate, thoughtless and needless use of certain agents
Tranquilizers, Blood transfusion, Thalidomide drug, cortisones, antibiotics etc