



TERATOLOGY



(For ICAR-JRF)

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TERATOLOGY

- It is the division of embryology and pathology dealing with the abnormal development and malformations of the antenatal individual.

Definitions

Anomaly:

- It refers to the malformation involving only an organ or part of the body.

Monster:

- It refers to an animal with extensive deformity.

Teratogens

- Variety of environmental factors or agents causing non- genetic anomalies or monsters.

Diploid Chromosome Number of Domestic Animals

- Cattle → 60
- Goat → 60
- Sheep → 54
- Buffalo (Riverine) → 50
- Buffalo (Swamp) → 48
- Horse → 64
- Donkey → 62
- Pig → 38
- Cat → 38
- Dog → 78
- Fowl → 78

Human → 46

Achondroplasia, or dwarf, “comprest” or “bull dog calves”

- Most common type → brachycephalic “snorter” dwarf in Herefords with’ → **short, broad head, bulging forehead, malocclusion of the jaw, prognathism of mandible, pot-belly, low viability and great susceptibility to bloat and dystocia.**
- Autosomal recessive defect with some modifiers.
- “bulldog” calves is usually aborted about the **fifth to eighth month of gestation.**
- **Hydramnios** occurs in pregnant Dexter cattle carrying a “bulldog” calf.



Achondroplasia



*Extreme
Achondroplasia*

Epitheliogenesis imperfecta

- It is a condition where **skin fails to form**.
- It occurs most commonly on the legs below the knees and hocks and on the muzzle, ears, tongue and mucous membranes.
- It has been described in **Holsteins**, Ayrshires, **Jerseys**, Brown Swiss and Shorthorns.



- **Hypotrichosis congenita** or alopecia is a recessive defect characterized by degrees of hairlessness in Holsteins, Polled Herefords.

- **Acroteriasis congenita** or amelia and hemi melia is seen in Holsteins and Brown Swiss and other breeds. **This is characterized by missing, shortened, deformed, or “amputated” limbs.**

- **Muscle contractures and ankyloses, or arthrogryposis** has been reported as a recessive in Dole cattle in Norway; and a dominant with incomplete penetrance in England.
- **Hydrocephalus** in Herefords, Ayrshires, Holsteins and other breeds. It is characterized by the birth of “dummy” or “bawler” calves that are unable to nurse properly and die in several days. The heads may be enlarged or normal in size but section of the head and brain reveals distended ventricles.



External hydrocephalus



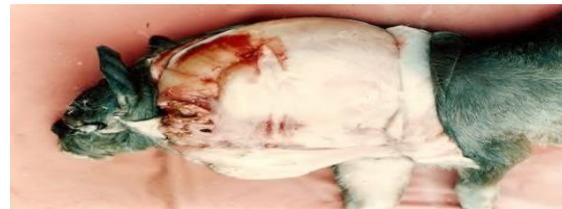
Internal hydrocephalus



Hydrocephalus in Goat

INHERITED AND GENERALLY NONLETHAL DEFECTS IN CATTLE

- **Polydactylysm** → An autosomal dominant character with incomplete penetrance.
- **Syndactylysm** or “**mule-foot**” → single autosomal recessive. The front feet of the Holstein calves were much more frequently affected with syndactyly than the rear feet.
- **Muscular hypertrophy** or “**double**” **muscling** is characterized by reduced fat deposits, light bone, thin skin, and large muscles. When fetuses are affected dystocia often occurs.



Double Muscling in Cattle

- ***Vestigeal tail*** (Holsteins, Angus, Shorthorns).
- ***Fused teats*** (Guernseys, Herefords).
- ***Supernumerary teats*** (all breeds).
- ***Missing phalanges*** or “**Creeper**” calves (Swedish cattle).
- ***Impacted premolars*** and “**parrot-mouth**” (Shorthorns) Short spine (Norwegian cattle).
- ***Agnathia or absence of a lower jaw*** (Jerseys and other breeds) Opacity of the cornea is probably a recessive character in Holsteins.
- ***Dermoid cysts on cornea***, (Herefords and Guernseys).

Non-Genetic Teratological Defects

Susceptibility

- The period of early differentiation in the embryo or about the time germ layers and organs are developing - Highly susceptible.

Susceptible



- The zygote is not as susceptible to teratogens during the period of the ovum or blastula or the period of the fetus as it is during the period of the embryo and organogenesis, especially the first half of that period.

TERATOGENIC AGENTS OR FACTORS

Nutritional deficiencies in the dam

- Vitamin A and E, riboflavin, folic acid, pantothenic acid, niacin and other vitamin deficiencies, minerals such as iodine and possibly manganese, and amino acids such as tryptophane may cause congenital defects. Hypervitaminoses A and D will also cause anomalies.

Endocrine disturbances of the dam

- Diabetes, thyroid malfunction, and large exogenous doses of glucocorticoids, ACTH, insulin, androgens, progestagens, estrogens, thyroxine and thiouracil will cause defects of the embryo. Large doses of glucocorticoids in pregnant animals at the proper stage of gestation may cause cheilo or palatoschisis. Progestagens given during pregnancy may cause masculinization of the genitalia of female fetuses.

Physical factors

- Reduced atmospheric pressures, hypothermia, hyperthermia and, anoxia cause anomalies.

Radiation

- X-ray or radioactive substances induces congenital defects.

Drugs or chemicals

- Thalidomide, quinine, sulphonamides, tetracycline, streptomycin, salvarsan, lead, mercury, nicotine, malathion, carbon tetrachloride, apholate, selenium, fluorine, cytotoxic agents including aminopterin in sheep, nitrogen mustard, actinomycin D, 6 mercaptopurine, azoserine, azo dye, trypan blue and other dyes, salicylates, histamines, ergot, “Diamox,” reserpine, phenylmercuric acid, galactose, E.D.T.A. , Veratrum californicum and locoweeds possibly containing lathyrogens, all produce fetal anomalies in animals under certain conditions.

Infections

- Blue tongue in sheep, hog cholera in swine, feline panleucopenia in cats, bovine virus diarrhea- mucosal disease virus, and toxoplasma can cause anomalies in the embryo.

Ageing of ova

- By delaying ovulation 24-48 h was characterized by a **three-fold increase in chromosomal anomalies** with a higher incidence of embryonic death in rats. Similarly ageing of rabbit spermatozoa before permitting them to fertilize eggs resulted in normal fertilization but greater embryonic death losses. Thus age affects the genes and chromosomes as does other agents.

Hydrocephalus

- Occurs due to an abnormal accumulation of fluid in the cranial cavity.
- Internal hydrocephalus is due to excessive fluid in the ventricular system.
- External hydrocephalus is rare and due to excessive fluid between the brain and dura mater.
- Internal and external hydrocephalus may be combined.

SCHISTOSOMUS REFLEXUS

- Seen most commonly in cattle, rare → sheep, goats, swine.
- **Marked ventral curvature of the spine so the occiput of the head lies near the sacrum.**
- **The body and the chest walls are bent laterally and the thoracic and the abdominal viscera are exposed.**
- The pelvis is deformed, liver is abnormal in shape and cystic.
- The rumen is occasionally distended with fluid.
- **The limbs are usually ankylosed and rigid.**
- In rare cases the limbs and head may be enclosed in a complete sac of skin.

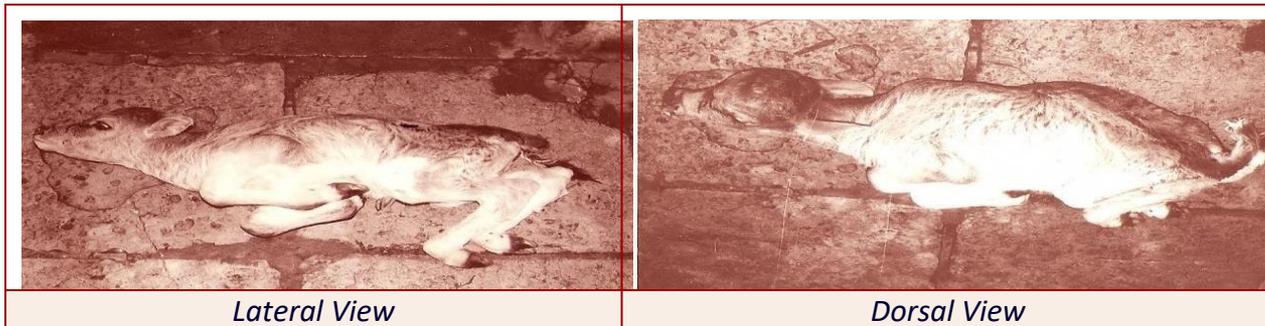


Figure 1: *Schistosomus reflexus* foetus removed by Caesarean-section.

Schistosomus reflexus
In Bovine

CAMPYLORRACHIS SCOLIOSA

- *Campylorrhachis scoliosa* is a fetal monster, rarely seen in cattle and swine.
- It is characterized by a lateral curvature of the spine.
- The limbs are usually deformed and ankylosed.



PEROSOMUS ELUMBIS

- Seen occasionally in cattle and swine.
- Characterized by a **lack of vertebrae and spinal cord caudal to the thoracic region.**
- The monster has a small, flattened, deformed pelvis with strongly ankylosed and flexed hind limbs and atrophy of the muscles of the rear quarters.

PEROSOMUS HORRIDUS

- *Perosomus horridus* is a bovine fetal monster with **general ankylosis and muscle contractures**.
- This is due to a marked **double S-shaped lateral twisting of the vertebrae**.
- It is characterized on external examination by a short spine.



*Caprine Perosomus
Horridus*

- *Miscellaneous anomalies* due to displacement of tissues include dermoids, and dentigerous cysts.
 - **Dentigerous cysts**
 - Characterized by a displaced dental follicle containing fluid and teeth, is seen most commonly in the horse.
 - May be located beneath the ear and are called an “**ear tooth.**”
 - **Dermoids**
 - Seen occasionally on the cornea, third eyelid or on the neck in cattle and other species.
 - In horses dermoid tumors may rarely involve the ovary or testis, especially the retained testis.

AMORPHUS GLOBOSUS

Holocardius amorphus or Amorphus globosus

- ✓ The general body form is unrecognizable.
- ✓ It may occasionally be seen, most commonly in the cow, but also in the mare, sheep and goat attached to the placenta of the normal monozygotic or dizygotic twin.
- ✓ These very imperfect zygotes are parasitic upon the placenta of the normal twin and are never observed in single births.
- ✓ Usually appears as a round or oval, edematous structure weighing 1/2 to 7 lbs.
- ✓ Covered with skin and hair and containing connective tissue, fat and other soft tissues and occasionally cartilage and bone.
- ✓ ***Amorphus globosus* was an imperfect zygote of dizygotic twins.**
- ✓ The monster composed mainly of stomach and intestinal tissues.



Fig.1: Gross morphology of amorphus fetus with pigmented skin and a few hairs.

CONJOINED TWINS

Conjoined twins in which the components or component parts are symmetrical are called **Diplopagus monsters** or **“Siamese” twins**.

- Triplopagus is extremely rare.
- **Conjoined twins arise from a single ovum and are monozygotic.**
- Occurrence: about once in 100,000 bovine births.
- Most common in cattle but are seen rarely in sheep, pigs, dogs and cats and are extremely rare in horses.

CONJOINED TWINS

Type I: Those conjoined twins in which each component is complete or nearly so include

- **Thoracopagus, sternopagus, or ziphopagus** twins are joined at or near the sternal region. The internal organs are usually duplicated. The components are face to face.
- **Pygopagus monsters** are connected at the sacrum and the components are back to back.
- **Craniopagus twins** are united at the heads. Components may be facing in the same or in the opposite direction.
- **Ischiopagus fetuses** are joined at the lower pelvic region and the bodies extend in a straight line and the heads in the opposite direction.

Type II: The two components equal one another in this group but each is less than an entire individual.

- Usually associated with lateral fusion.

- May vary from single normal individuals to those of two normal but superficially joined individuals.
- Duplication may lead to doubling of the cranial end of body while the caudal end remains single; or the caudal part may be doubled and the cranial part single.
- Duplication can occur at both cranial and caudal ends with the middle area of the monster remaining single.
- Duplication, of the cranial part of the fetus is more common than that of the caudal portion.

DUPLICATION IN THE CRANIAL REGION

Monocephalus

- Monsters with partial duplication of the frontal region, nose and mouth are referred to as Diprosopus or double face.
- Either face may be complete or one eye of each may be fused into a common medial orbit. Di-, tri- or tetraophthalmus and di-, tri- or tetraotus may be present.

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DUPLICATION IN THE CRANIAL REGION

Dicephalus or two heads, with distomus or monostomus occasionally is seen.

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*Feline Double Monster: Monocephalus,
tetrapus
tetrabrachius*

- A Dicephalus dipus dibrachius monster has two fore- limbs and two hind limbs with partial duplication of the spine and one or two tails, dicaudatus.
- Dicephalus dipus tribrachius has 3 forelimbs
- Dicephalus dipus tetrabrachius has 4 forelimbs.

DUPLICATION IN THE CAUDAL REGION

Duplication in the caudal region is designated as Dipygus. Tripygus is very rare.

- Monocephalus tripus dibrachius has 3 rear limbs.
- Monocephalus tetrapus dibrachius has 4 rear limbs.
- Cephalothoracopagus has a single neck and more or less complete fusion of the heads to form an almost single face.
- Syncephalus has one face, four ears, and a single or partially doubled cerebrum.
- Janiceps is a monster with two faces on opposite sides of the head.

DUPLICATION OF CRANIAL AND CAUDAL REGIONS

- Duplication of both cranial and caudal regions is Dicephalus dipygus.
 - Dicephalus tripus tribrachius
 - Dicephalus tetrapus tetrabrachius
 - Dicephalus tripus tetrabrachius, or
 - Dicephalus tetrapus tribrachius

UNEQUAL AND ASYMMETRICAL CONJOINED TWINS

- Unequal and asymmetrical conjoined twins are composed of one very imperfect and incomplete twin, called the *parasite*, dependent on the other twin, the *autosite*. This is called a *heteropagus monster*. The autosite is nearly normal and the parasite is attached to it as a dependent growth.
 - The parasite may be attached to the visible surface of the autosite. Common junction sites are the back, thorax, sacrum or pelvis, and in rare cases the abdomen, head, or palate. The latter is called *epignathus*. Some of the smaller, more imperfect parasites may be called teratomas.
 - A parasite can rarely develop within the autosite usually in the abdominal, thoracic, pelvic or cranial cavity, or in the spinal canal or scrotum.
 - Teratomas in the abdominal cavity and between the mandibles have been described in the past as

Thank You