Viral diseases characterized by oral lesions and diarrhea in cattle

Rinderpest

- Rinderpest.
- Bovine viral diarrhea(BVD) – Mucosal disease (MD).
- Bovine malignant catarrh- Bovine malignant catarrhal fever (MCV).
- Alimentary form of infectious bovine rhinotracheitis (IBR).

Rinderpest
(cattle plague)

Rinderpest outbreak in 18th Century Netherlands

Rinderpest

- Rinderpest (RP) is an acute or subacute, highly contagious viral disease of ruminants and swine caused by a Morbillivirus. it is of major importance to the cattle industry. In its acute form it is characterized by inflammation and necrosis of mucous membranes and a very high mortality rate.

Rinderpest, the most dreaded bovine plague known

- Rinderpest is (was is possibly more accurate) an ancient disease of cattle, believed to have been the origin of human measles.
- Caused by an epitheliotropic and lymphotropic morbillivirus. Characterised by high fever, ocular and nasal discharges, dysentery, and dehydration it can cause death in up to 100% of cattle, water buffaloes, and yaks.

Sudden mortality.

Mortalité brusque.

Salivation

Ulcerative lesions on the gingivia.

Ulcères gingiviaux.

Ulcerative and necrotic lesions on the tongue.

Ulcères et plaques nécrotiques sur la langue.

A case of rinderpest, showing ocular discharge

Rinderpest is characterized by

*High fever.

*Lachrymal discharge.

*Inflammation, hemorrhage, necrosis, erosions of the epithelium of the mouth and of the whole digestive tract.

* Profuse diarrhea.

*Dehydration.

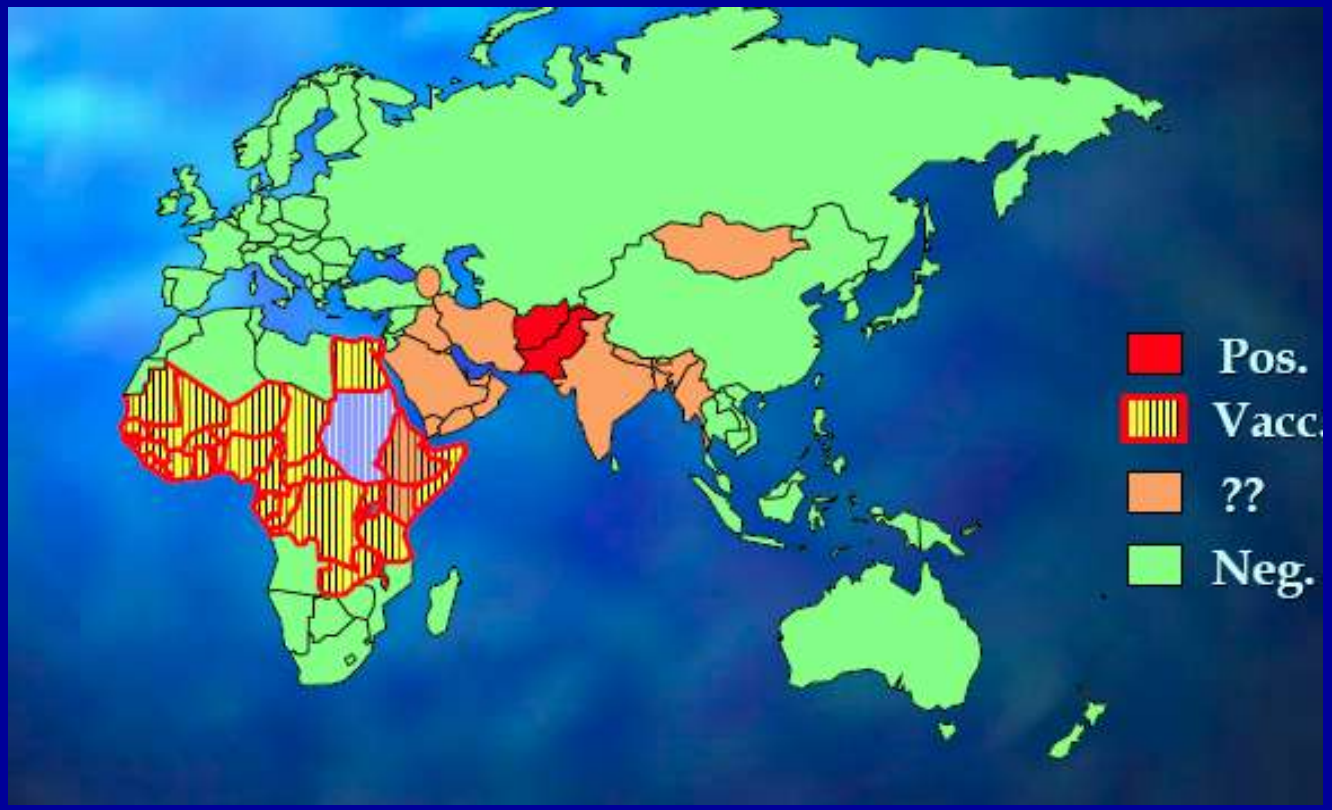
Rinderpest

Etiology

- Family: Paramyxoviridae
- Genus: Morbilivirus
- Type: only one, with differences in virulence.
- RNA virus.

virus is very fragile,

- Does not survive outside the host for many hours.
- Inactivated in sunlight within 2 hours and by putrefaction.
- RP virus is inactivated by strong acid or alkaline conditions, and chemical agents as 5 % chloroform, 2 % phenol, and 2 % formalin within 10 minutes.

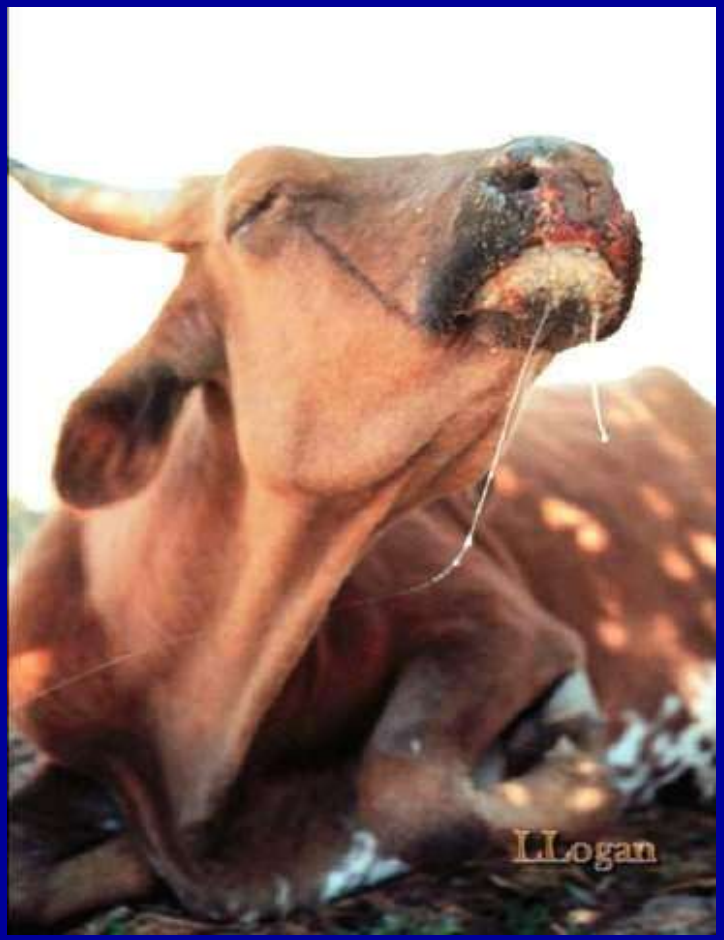


The virus was widely distributed throughout Europe, Africa, Asia and West Asia, but never became established in either the Americas or Australia/New Zealand

However, it currently remains endemic

in the Indian subcontinent, the Near East, Egypt, and sub-Saharan Africa

Rinderpest



High Mortality

High morbidity, High mortality, Morbidity can be greater than 90% in cattle.

Host Range

All cloven-hoofed animals are susceptible (not all are clinical)

Most clinical cases occur in cattle and water buffalo

Host Range

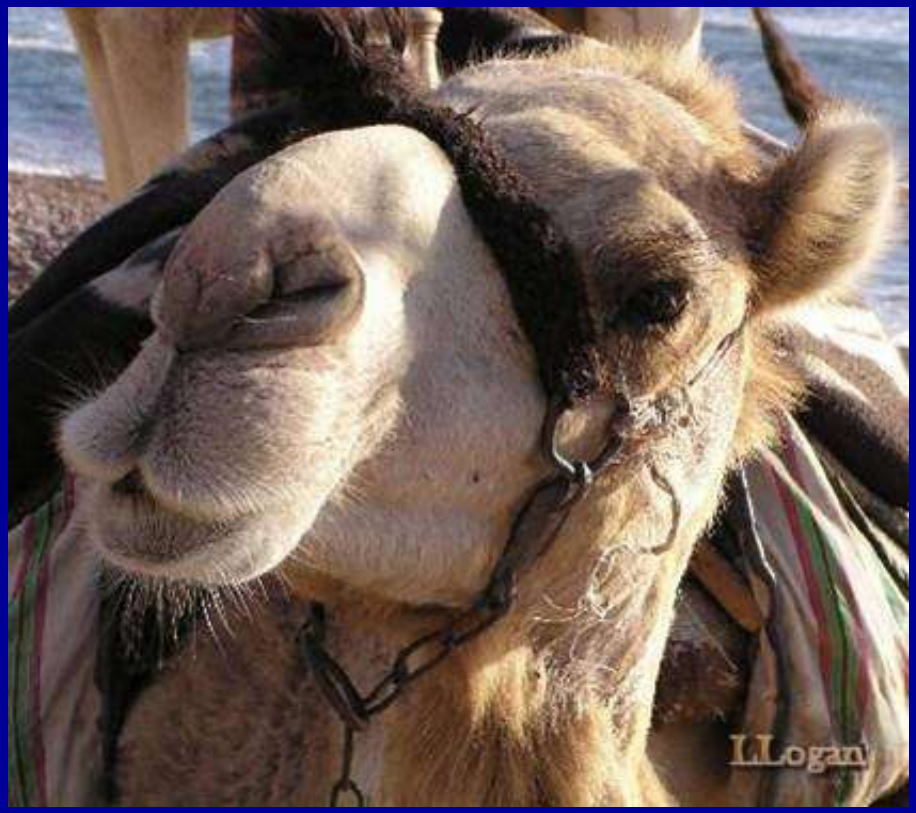
- Sheep, goats, and yak are mostly subclinical

http://www.geo.arizona.edu/dgesl/research/regional/asian_monsoon_dynamics/yak.htm

Yak, wild Tibet cattle

Host Range

- Camels – asymptomatic infections only



Incubation period

Varies with;

*strain of RPV,

*dosage,

*and route of exposure (3-15 days)

Virus excretion

Virus excretion by;

- infected animal,
- animals in incubation period and
- subclinically infected animals,
- in urine, faeces, nasal discharge and perspiration (sweating)

Transmission

Transmission requires direct or close indirect contact because the virus does not survive long outside the host.;

- Inhalation of aerosols.
- Ingestion of contaminated feed.

*Virus is present
in blood and secretions
BEFORE
symptoms appear

Pathogenesis:

- Following primary growth in lymph nodes associated with the nasopharynx.

- Virus proliferates throughout the lymphoid tissue and spreads via the mononuclear blood cells to the mucosae of the GI and upper respiratory tracts.
- Virus has high affinity for leukocytes, and it replicates inside lymphocytes, monocytes and epithelial cells .

- There is striking destruction of lymphocytes in lymphoid tissues leading to leukopenia.
- Tissue damage represented by focal necrotic stomatitis and enteritis is caused by direct effect of viral replication (Cytopathology).

- Viral antigens induce a potent immune response that controls the infection and allows recovery if tissue damage is not too severe.
- Death is usually due to severe dehydration.
- In less acute cases death is due to activation of latent parasitic or bacterial infections.

General Clinical signs

- Fever
- Depression
- Nasal & lachrymal secretion
- Congested mucosa
- Mucosal erosions
- Severe diarrhea
- Leukopenia
- Death

The “four D’s” of Rinderpest:

Depression

Diarrhea

Dehydration

Death

Clinical signs in cattle

Three forms of disease

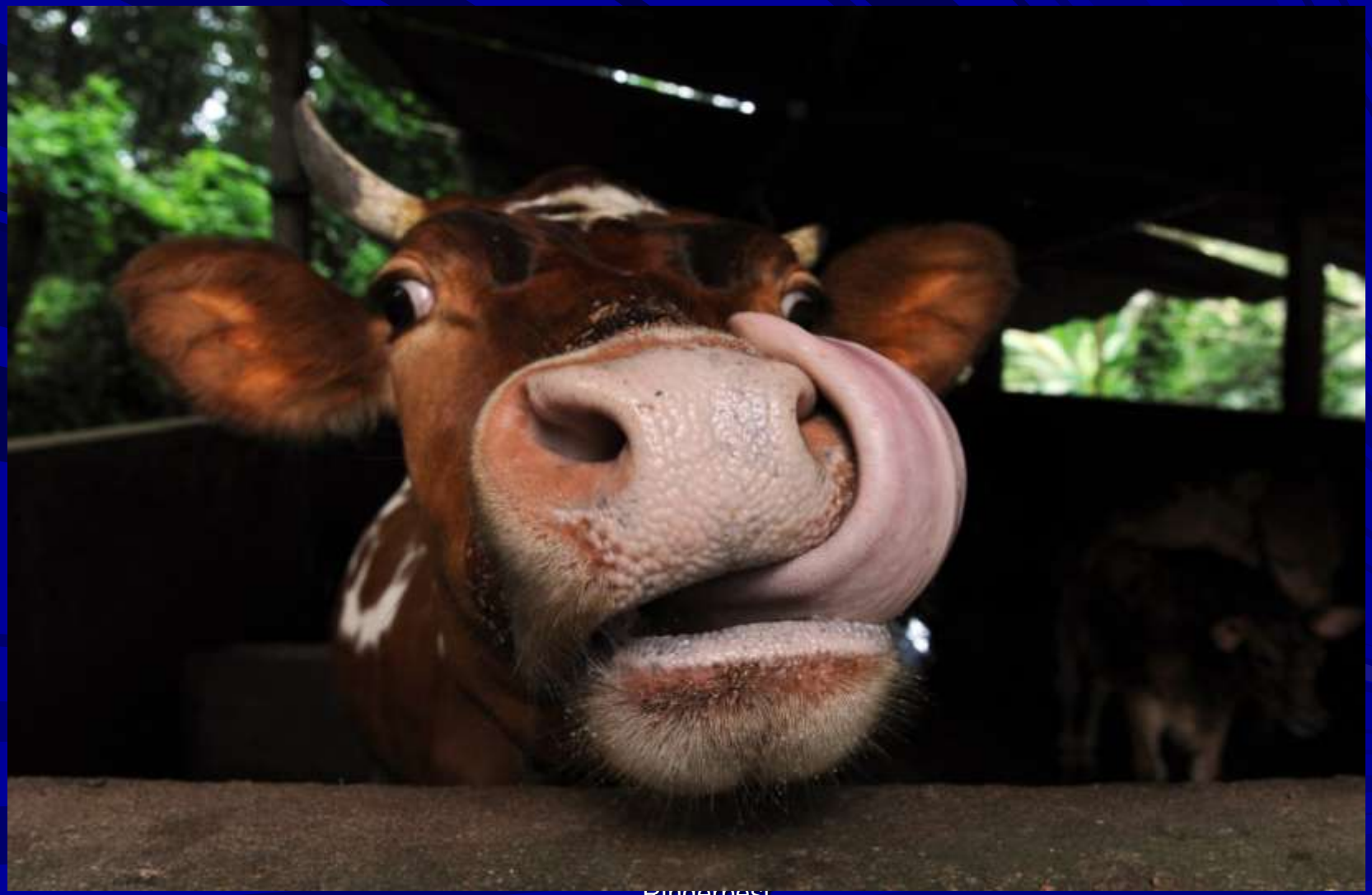
- –Acute or Classic form.
- –Peracute form.
- – Subacute (Inapparent form)

Clinical Signs in cattle

1. Peracute Form.

- It is not common except after experimental infection.
- Naturally most often found in highly susceptible young and newborn animals.
- High fever (40-42 °C)
- Congested mucous membranes.
- Respiratory distress and death.

A cow licks its muzzle in Padukka, Sri Lanka, where the U.N. has worked to eradicate rinderpest.



Clinical Signs in cattle

2. Acute Form.

Acute (classic) form is seen in naïve cattle in areas or countries that were free of the disease.

Clinical Signs in cattle (Acute Form)

- Incubation period from 6-9 days.
- Several days of high fever (40-42°C), without mucosal lesions.
- Anorexia and Depression.
- Fall in milk yield.
- Serous oculo-nasal discharge

- After a period of depression, appearance of clear ocular discharge (lachrymation, epiphora or ‘tearing’) -

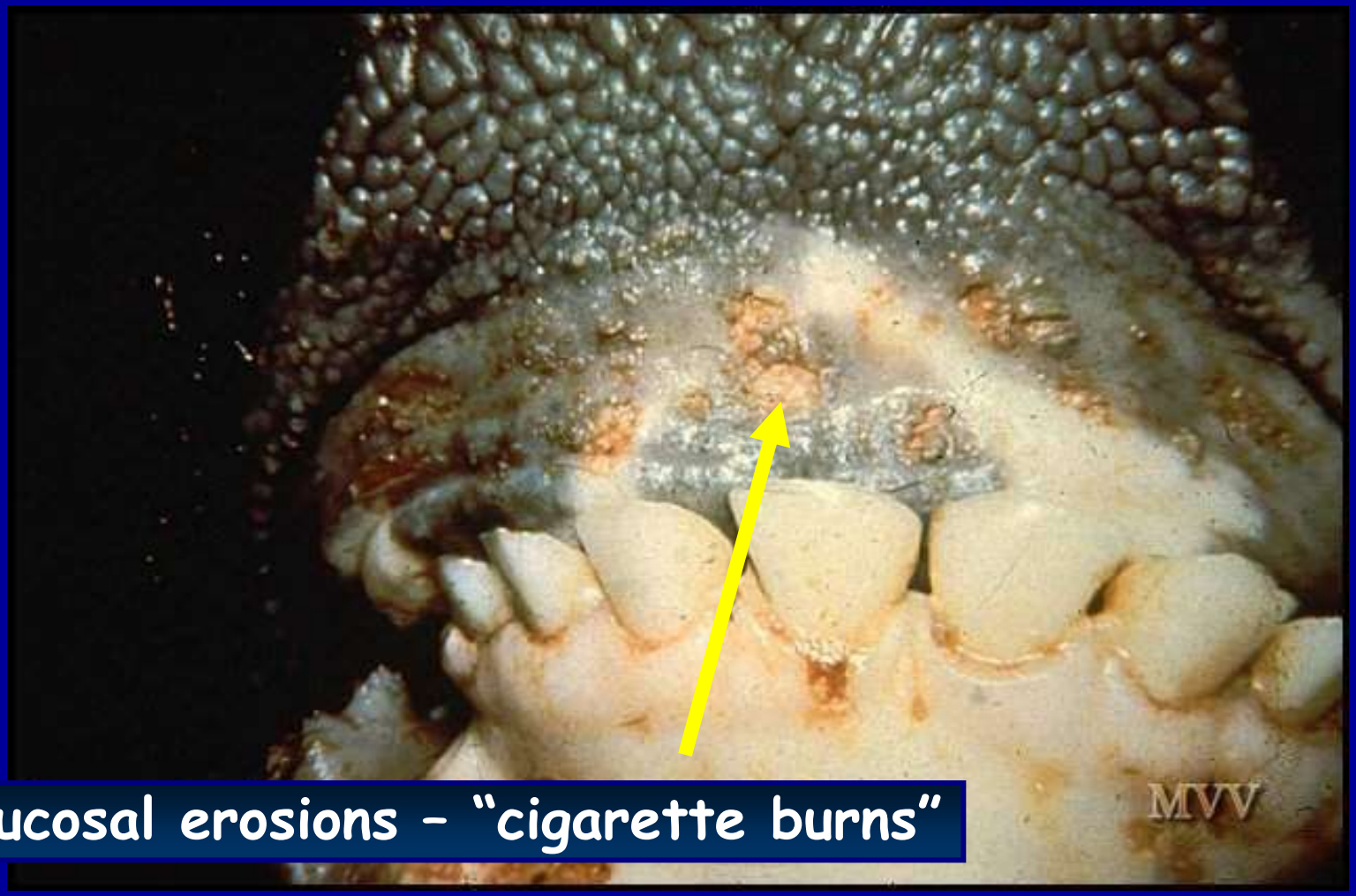
This is followed by mucosal phase,

- Inflammation of buccal, nasal and conjunctival mucosae, and in some cases hyperemia of vagina and swelling of vulva.
- More profuse purulent lacrimation accompanied by blepharospasm.
- Bubbly, clear, blood stained saliva, followed by purulent saliva and halitosis **(bad breath)**.

- Appearance of discrete, grayish, raised necrotic lesions (1-5mm in diameter), first on the inside of the lower lips, adjacent gums, on the cheek mucosae and commissures, lower surface of the tongue.

Early focal mucosal lesions

At first punctate, the lesions tend to enlarge. The erosions here are overlain with necrotic epithelium.



Mucosal erosions – "cigarette burns"

- Later they generalized in the mouth, including dorsum of the tongue, similar lesions are formed on the nasal, vulval and vaginal mucosa.
- The necrotic mucosa sloughs, leaving raw, red areas with sharp edges. These may coalese forming shallow ulcers.
- Vesicles are not present.

Another view of discrete, punctate erosions and clearly visible deep erosions around the roots of the incisor teeth.

Shallow erosions in the mouth Note how these have a sharp margin

The lesions can extend sufficiently to coalesce, here covered completely by necrotic epithelium. Note also the erosions around the roots of the incisors.

Advanced mucosal erosions

- Severe diarrhea, dysentery and tenesmus (may be watery or hemorrhagic), with fetid odour develops as lesions appear in the abomasums and intestine.
- Skin lesion in the perineum, scrotum , flanks, inner aspects of thigh and neck are less common.

- After a period of illness lasting from 3-5 days; there is sudden fall in temperature with exacerbation of mucosal lesions.
- Other signs include dyspnea, cough, abdominal pain.
- Prostration with further fall in temperature to subnormal levels occur on day 6-12, after which death occur within 24 hours.
- pregnant cows may abort at this stage discharging virus with the fetus and vaginal discharge for 24 hours.
- A few animals may recover .

3. Subacute form:

- Mostly seen in enzootic areas, together with a skin form with less morbidity and mortality.
- Mild temperature reaction, mild anorexia and malaise.
- The inflammation of mucosae is catarrhal and there is no dysentery.

- Small papules may develop on the neck, inner side of thighs and scrotum.
- Most animals will recover with short convalescent period. However because of severe lympholysis, latent pathogens particularly *Anaplasma marginale* are often activated and the resultant disease overshadow Rinderpest.
- In Africa corneal opacity has been associated with Rinderpest in buffalos.

- Vesicle can be seen in the whole body of the cow.

Clinical Signs

The front of the dental pad is another common site to find erosions. In these shown here the epithelium has been debrided clearly showing the depth of the erosion. Note also the severe inflammation of the cheek papillae.

Advanced mucosal erosions

African Lineage 1

Southern Sudan 1998

Additional Clinical Signs

In Africa it includes corneal opacity which has been associated with rinderpest in buffalos and lesser kudus but has also been noted in calves together with dermatitis.

Clinical Signs

Depression

Diarrhea

Dehydration

Death

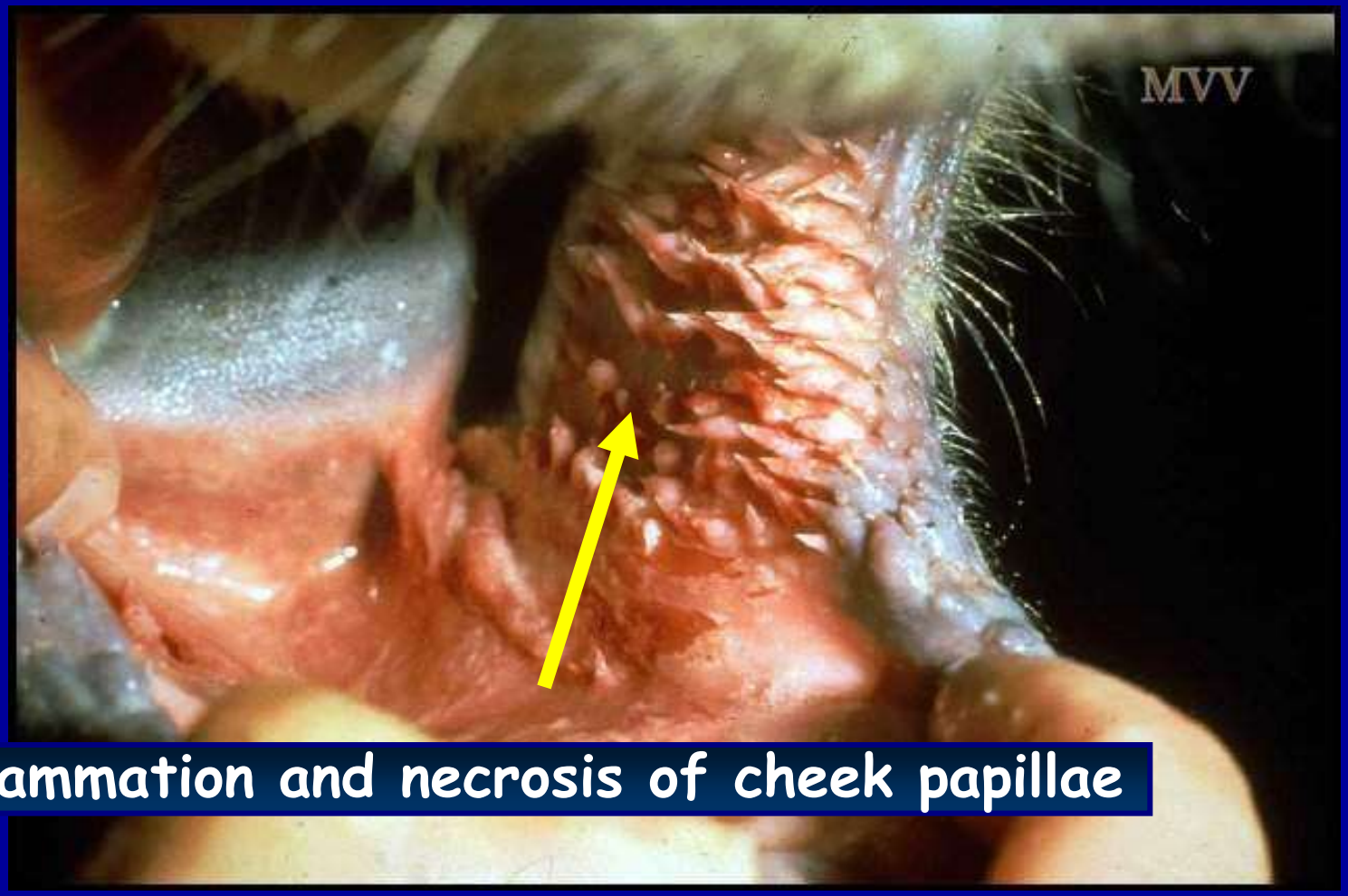
Rinderpest

Clinical Signs

- Photophobia
- Conjunctivitis

Field case of rinderpest from Libya.
This animal had lacrimation,
diarrhea, anorexia as well as a fever,
increased heart and respiratory rates.

Clinical Signs



Inflammation and necrosis of cheek papillae

- Mucopurulent conjunctivitis with scleral erosions

Ocular discharge rapidly become catarrhal and then purulent as a result of secondary bacterial infection. These secretions may dry and clog the nasal passages and eyes, also causing excoriation of skin.

Purulent discharges

The purulent discharge from eyes, nose and mouth may be so severe as to resemble the ‘head-and-eye’ form of malignant catarrhal fever (MCF).

Clinical Signs

Extensive mucosal erosion

Clinical Signs

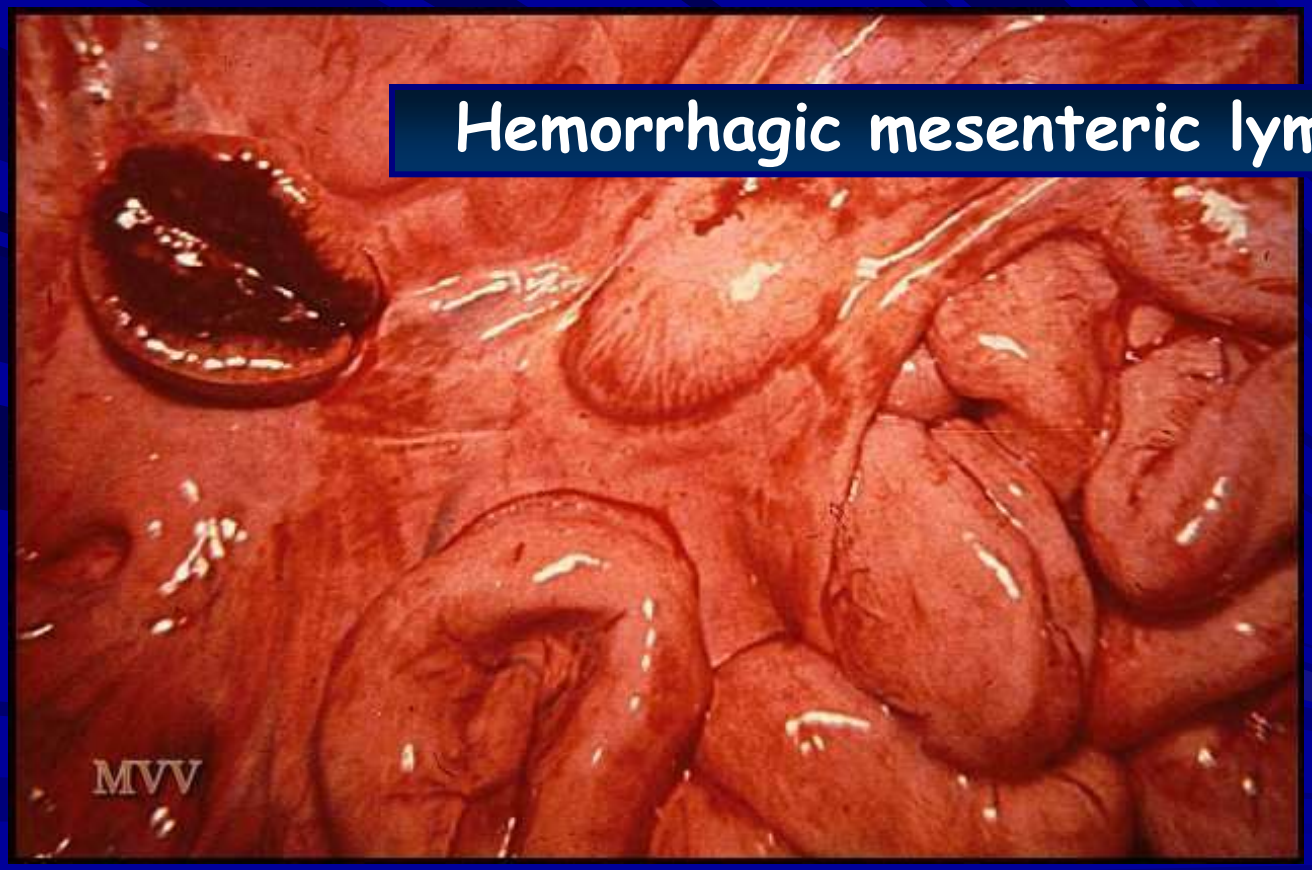
Profuse diarrhea and dysentery

Necropsy: Characteristic mouth lesion, Dehydrated and emaciated carcass

Necropsy findings and Lesions

Gastro-enteritis

Lesions



Hemorrhagic mesenteric lymph nodes

Lesions

Hemorrhagic Peyer's patches

Lesions

Linear petaechial haemorrhages in colon
Zebra strips

Bovine, colon. The mucosa contains multiple linear hemorrhages (Zebra strips)

Bovine, trachea. The mucosa is hyperemic and covered by abundant mucopurulent exudate.

marked oedema and congestion accompanied by petechiae or larger haemorrhages, particularly along the crests of the longitudinal folds could be very striking, giving the description **zebra striping**

"Zebra striping" in the colon

Diagnosis

- Serum

Diagnosis

1. Clinical signs, history and pathological changes are highly suggestive of Rinderpest.

2. Blood examination reveals lymphocytic leukopenia, total WBC count may fall to 4000/ul.

3. Virus isolation and identification.

Samples

- Conjunctival Fluid
- Intestinal contents or feces
- Whole blood, leukocyte fraction of whole blood that has been collected into heparin or EDTA.
- Lymphoid tissue (prescapular or mesenteric), lung, intestine, spleen of dead animals. Samples should be transferred to the laboratory on ice, but never frozen.

4. Antigen detection: Rinderpest antigen can be demonstrated using the agar-gel immunodiffusion test (AGID), the sandwich ELISA or Polymerase chain reaction (PCR).

5. Serology: Detection of specific antibodies in serum using a monoclonal antibody based Competitive ELISA or virus neutralization test.

- Important note. Samples are collected from different animals, at 3-5 days after fever commences. The proportion of positive reactors fall sharply after diarrhea commences and in moribund or dead animal.

Differential Diagnosis

- Bovine virus diarrhea (BVD).
- Mucosal disease (MD).
- Alimentary form Infectious bovine rhinotracheaitis (IBR).
- Malignant catarrhal fever (MCF).
- Vesicular stomatitis.
- Foot-and-mouth disease (FMD).

Differential Diagnosis

- Salmonellosis
- Necrobacillosis
- paratuberculosis
- Bluetongue / EHD
- Mycotic Stomatitis

Control:

1. In endemic areas, control is by annual vaccination, vaccine prepared from one strain will protects against all other strains.
2. When epidemics occur in normally free area, it is necessary to:

- Slaughter and strict quarantine measures.
- Prevent movements of both living animals and fresh animal products.

- All susceptible animals in infected and in contact groups should be slaughtered and disposed in the same farm.
- Cleaning and disinfection of infected premises.
- All ruminants in the surrounded danger area should be vaccinated with live attenuated vaccine (ring vaccination).

- An international campaign against rinderpest progressively reduced the number of countries affected and the disease was officially declared eradicated from the planet in 2011.
- Rinderpest is the first animal disease to have been entirely eradicated in the history of humankind.

Response to treatment	Pathology & clinical pathology	Clinical findings	Epidemiology	Disease				

Rinderpest