Rinderpest

Texas A&M University
College of Veterinary Medicine

Jeffrey Musser, DVM, PhD, DABVP
Suzanne Burnham, DVM

2006

Special note of thanks

Many of the excellent images and notes for this presentation are borrowed from these 2 sources

- From “Rinderpest” a presentation and notes by Dr Moritz van Vuuren, delivered at the Foreign Animal and Emerging Diseases Course, Knoxville, Tenn., 2005

- From “Rinderpest” a presentation and notes by Dr Linda Logan delivered to many and diverse audiences including the Colorado Foreign Animal Disease Course of Aug 1-5, 2005, Plum Island Foreign Animal Disease Diagnostics Course and others

Rinderpest

- Rinderpest (RP) is an acute or subacute, contagious viral disease of ruminants and swine, and of major importance to the cattle industry

Rinderpest

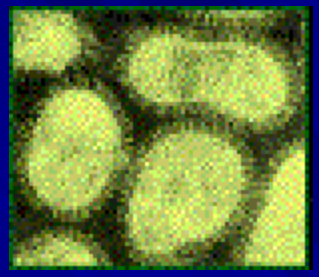
Rinderpest is characterized by high fever, lachrymal discharge, inflammation, hemorrhage, necrosis, erosions of the epithelium of the mouth and of the digestive tract, profuse diarrhea, and death.

The “four D’s” of Rinderpest:

- Depression
- Diarrhea
- Dehydration
- Death

Rinderpest

The virus is relatively fragile and is immunologically related to viruses that cause

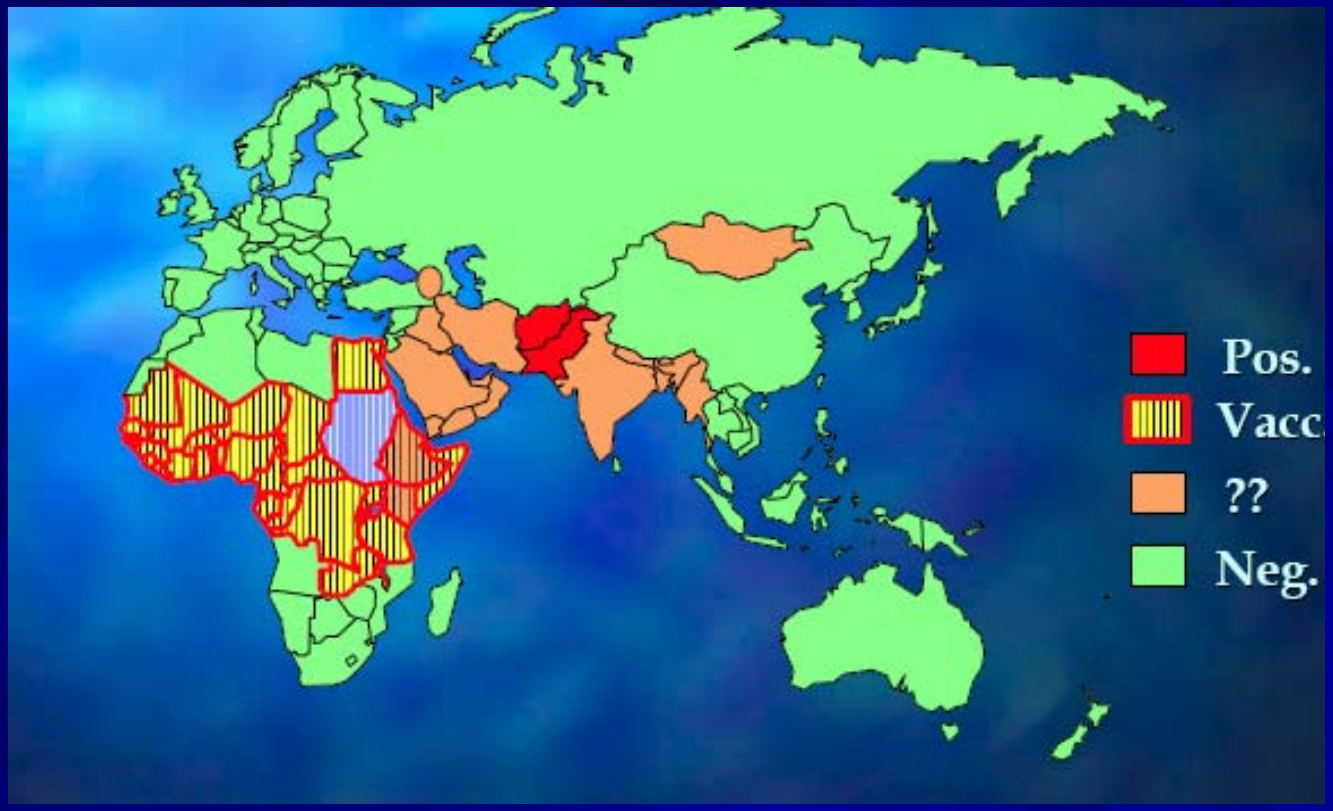


- canine distemper,
- measles, and
- peste des petits ruminants

Also known as “cattle plague”

rinderpest is a mucosal disease

Periodic pandemics of rinderpest throughout Africa for over 100 years….



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

Mass vaccination and eradication efforts have steadily decreased the prevalence of rinderpest in many of these areas

Rinderpest

http://spore.cta.int/spore118/images/brief01.jpg

However, it currently remains endemic

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

Rinderpest, the most dreaded bovine plague known, has changed the course of history many times over.

‘ Century after century, rinderpest swept west over and around Europe and east over and around Asia with every marauding army causing the disaster, death and devastation that preceded

1. *The fall of the Roman Empire*,
2. *The conquest of Christian Europe by Charlemagne*,
3. *The French Revolution*,
4. *The impoverishment of Russia* and
5. *The colonisation of Africa*.’

Rinderpest, Historic Legacy

- Concept of Quarantine & Indemnity
- Development of the clinical thermometer
- First mass vaccination campaign
- First Veterinary School: 1762 in Lyon, France

Rinderpest, Historic Legacy

- Veterinary Schools: Egypt (1827), India (1872)
- Creation of British Veterinary Dept. in 1866
- 1st International Veterinary Congress, Hamburg 1863
- Creation of OIE in 1920

Rinderpest

- Rinderpest is a disease reportable to the OIE.
- It is also on the USDA list of High Consequence pathogens.

Because rinderpest is easily transmissible between animals, it is a major concern for livestock producers

Rinderpest

From the FAO

"Rinderpest is the most dreaded bovine plague -- a highly infectious viral disease that can destroy entire populations of cattle and buffalo.

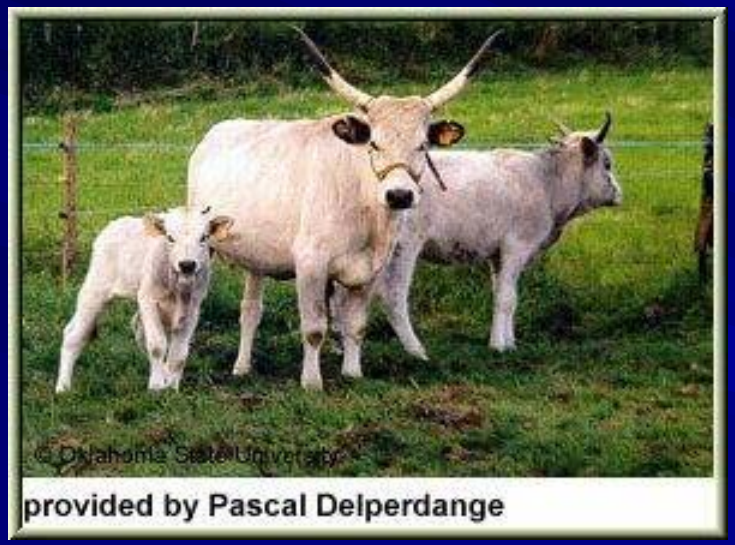
Bio-weapon

This disease ravaged cattle herds domesticated in Asia 8-9000 years ago and was used as a bio-weapon by marauding Asian armies.

Grey Steppe Cattle

- The secret weapons of the invaders were Grey Steppe oxen.
- Grey steppe cattle were asymptomatic carriers shedding rinderpest virus for months provoking epidemics that devastated buffalo and cattle populations of the invaded countries.
- The results were no transportation, untilled fields, starving peasants, and overthrown governments.

Grey Steppe Cattle



www.embryoplus.com/.../ images/hungrey1.jpg

www.ansi.okstate.edu/.../ greeksteppe-web-1.jpg

Rinderpest

Rinderpest

- Etiology
- Host range
- Incubation
- Clinical signs
- Transmission
- Diagnosis
- Differential Diagnosis

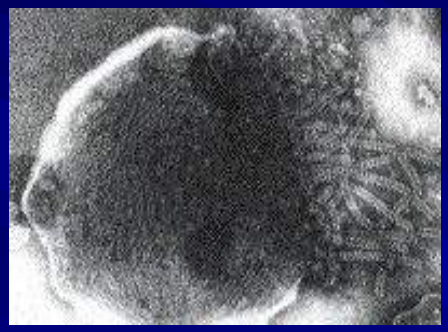
Etiology

- Family: Paramyxociridae
- Genus: Morbilivirus
- Type: only one, with differences in virulence

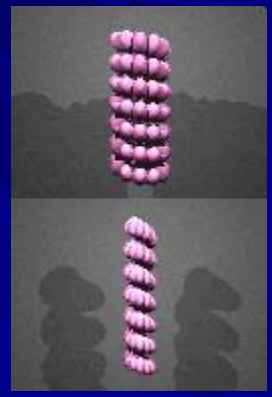
Rinderpest

Etiology

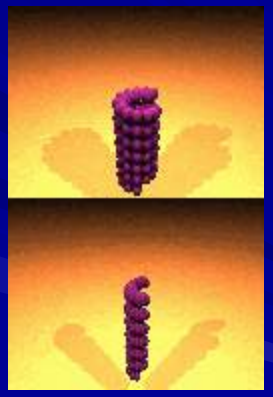
- Rinderpest electron microscopy



www.virology.net/ Big_Virology/EM/rpv2.JPG



Rinderpest virus



High Mortality

Can be a highly fatal disease

There is a good vaccine available and proper use of it can reduce fatality

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

- European pigs are quite resistant (subclinical);
- American javelina are very susceptible

http://home.wanadoo.nl/~schoelink/hippo%201.jpg

http://www.mobirds.org/Galleries/images/PKondrashov/Col%20peccary.jpg

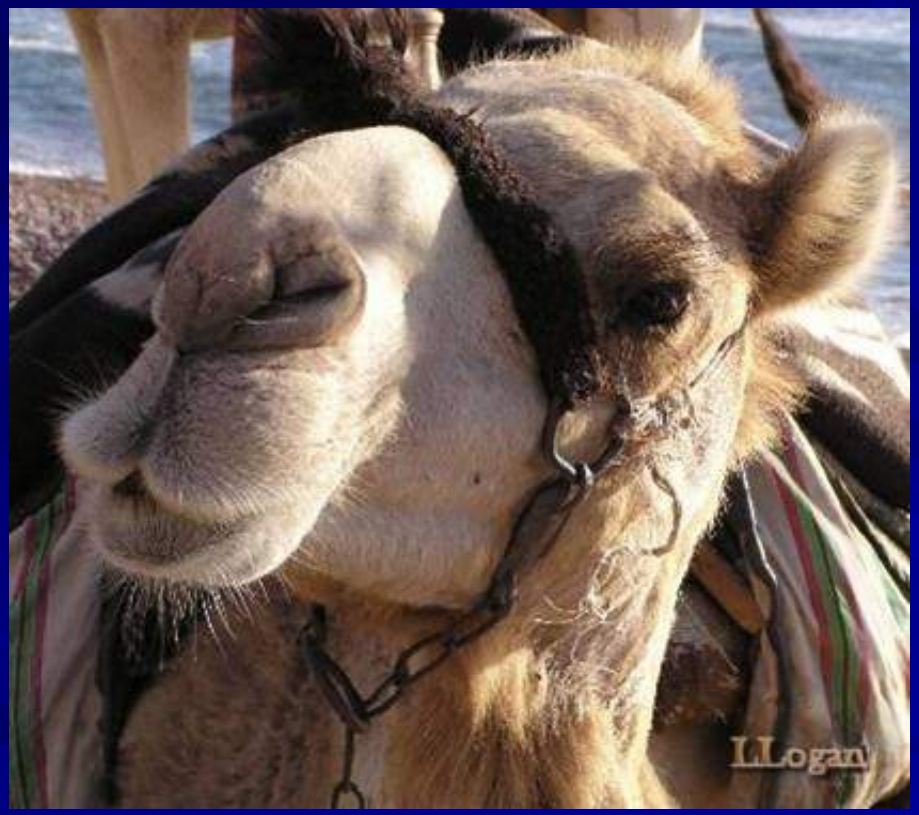
Host Range

- Sheep, goats, and yak are mostly subclinical

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

Host Range

- Camels – asymptomatic infections only



Host Range – Wild Animals

Most cloven-footed wild animals such as bison and deer

- Antelope
- Wildebeest
- Kudu
- Eland
- Giraffe
- Hippopotamus
- Gazelle
- Warthog

Incubation period

- Varies with strain of RPV, dosage, and route of exposure (3-15 days)
- Normally a range of 3-9 days (can be as short as 3-4 days in experimental infection; also, can be as long as 10-15 days with virus of low virulence)
- Duration: 2 or more weeks

**Virus is present*

in blood and secretions

BEFORE

symptoms appear

General Clinical Signs

- Clinical signs include: a high fever; red patches with discharge from around the eyes, nose and mouth; frothy saliva from the mouth; constipation followed by diarrhea. After a few days, the infected animal dies.

General Clinical signs

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

Clinical Signs in cattle

The case definition of rinderpest is ocular and nasal discharges with any two of the additional signs:

+ fever
+ erosions in the mouth
+ diarrhea
+ dehydration
+ death

Clinical signs in cattle

Two major forms of disease

- Acute or Classic form
- Peracute form

Clinical Signs in cattle (Peracute Form)

- Most often found in highly susceptible young and newborn animals
- No prodromal signs
- High fever (104-107 °F)
- Congested mucous membranes

Clinical Signs in cattle (Acute Form)

- Acute (classic) form characterized by pyrexia, erosive stomatitis, gastroenteritis, dehydration, and death
- Four stages
  1. Incubation period
  2. Febrile period
  3. Mucous membrane congestion
  4. Gastrointestinal signs

Clinical Signs in cattle (Acute Form)

- Fever - 104 to 107°F (40-42°C)
- Serous oculo-nasal discharge
- Leukopenia
- Depression
- Anorexia
- Constipation followed by diarrhea
- Oral erosions

Clinical Signs in cattle (Acute Form)

- Decreases in fever and viral titer
- Diarrhea (may be watery or hemorrhagic)
- Dehydration, emaciation
- Prostration and death 6 to 12 days after onset of illness

Clinical Signs

"Shooting" diarrhea

Clinical Signs

In Africa this also 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

- Early

  serous ocular discharge (Epiphora)

Clinical Signs

Depression

Diarrhea

Dehydration

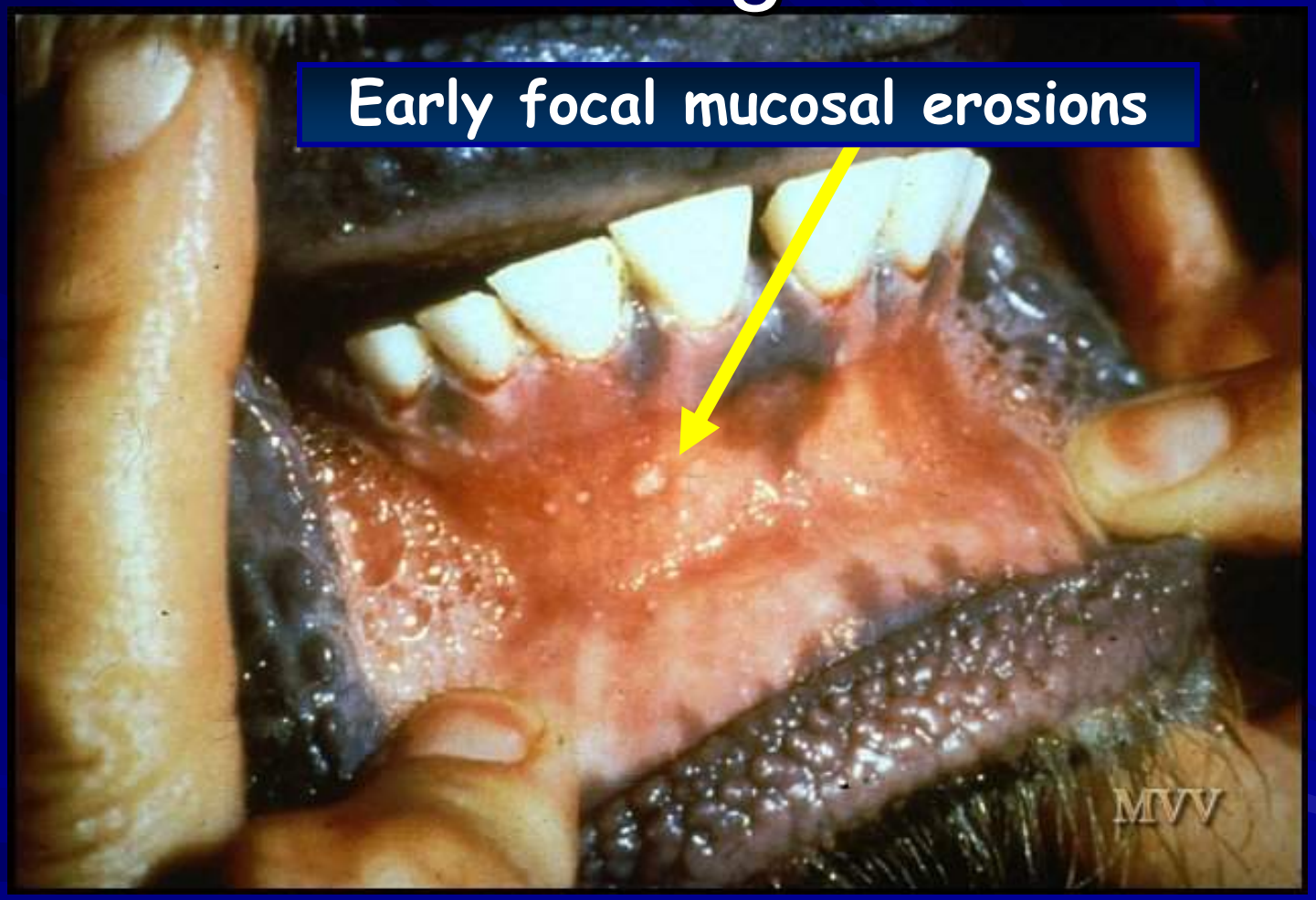
Death

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.

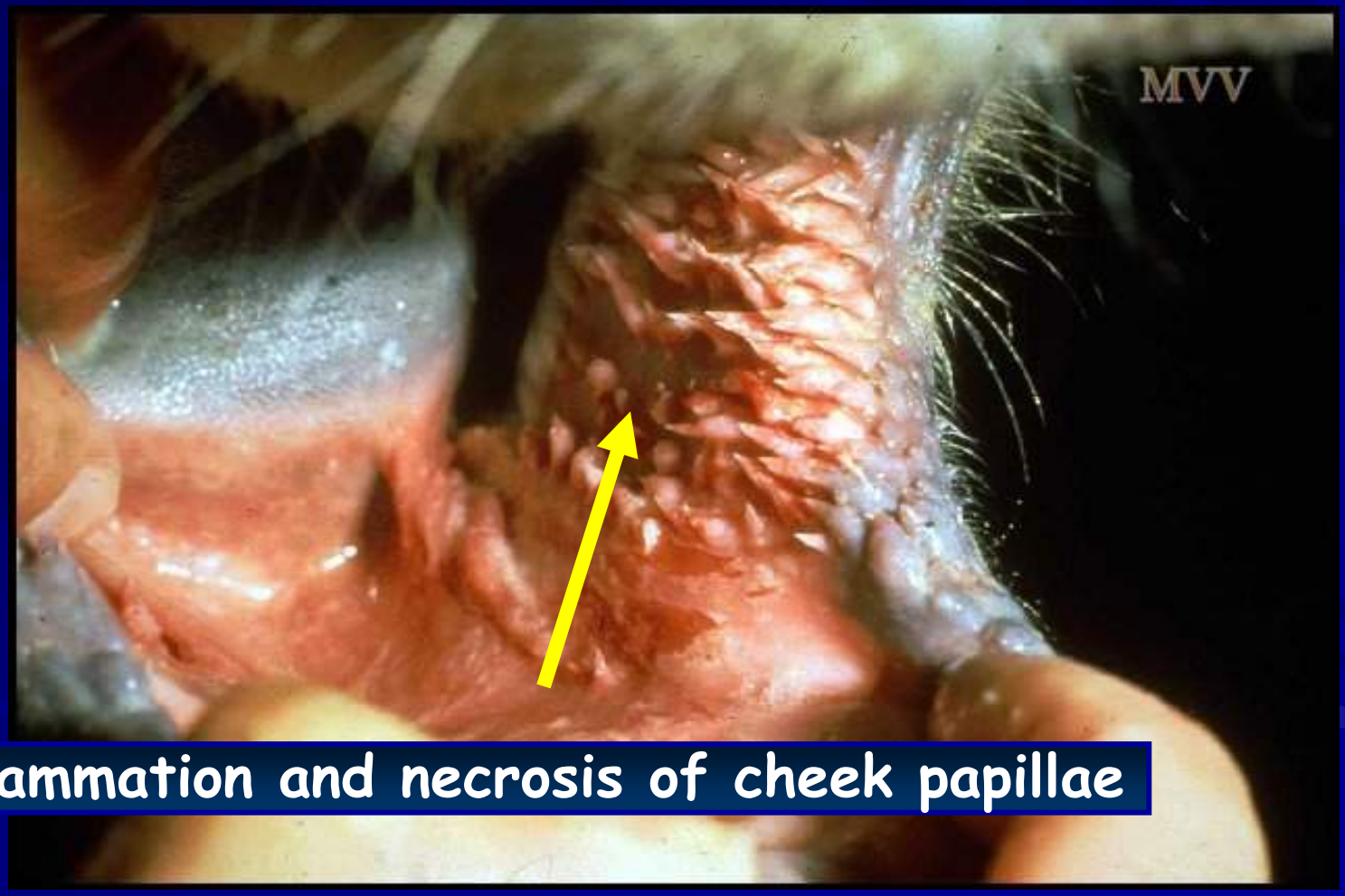
Clinical Signs



Clinical Signs

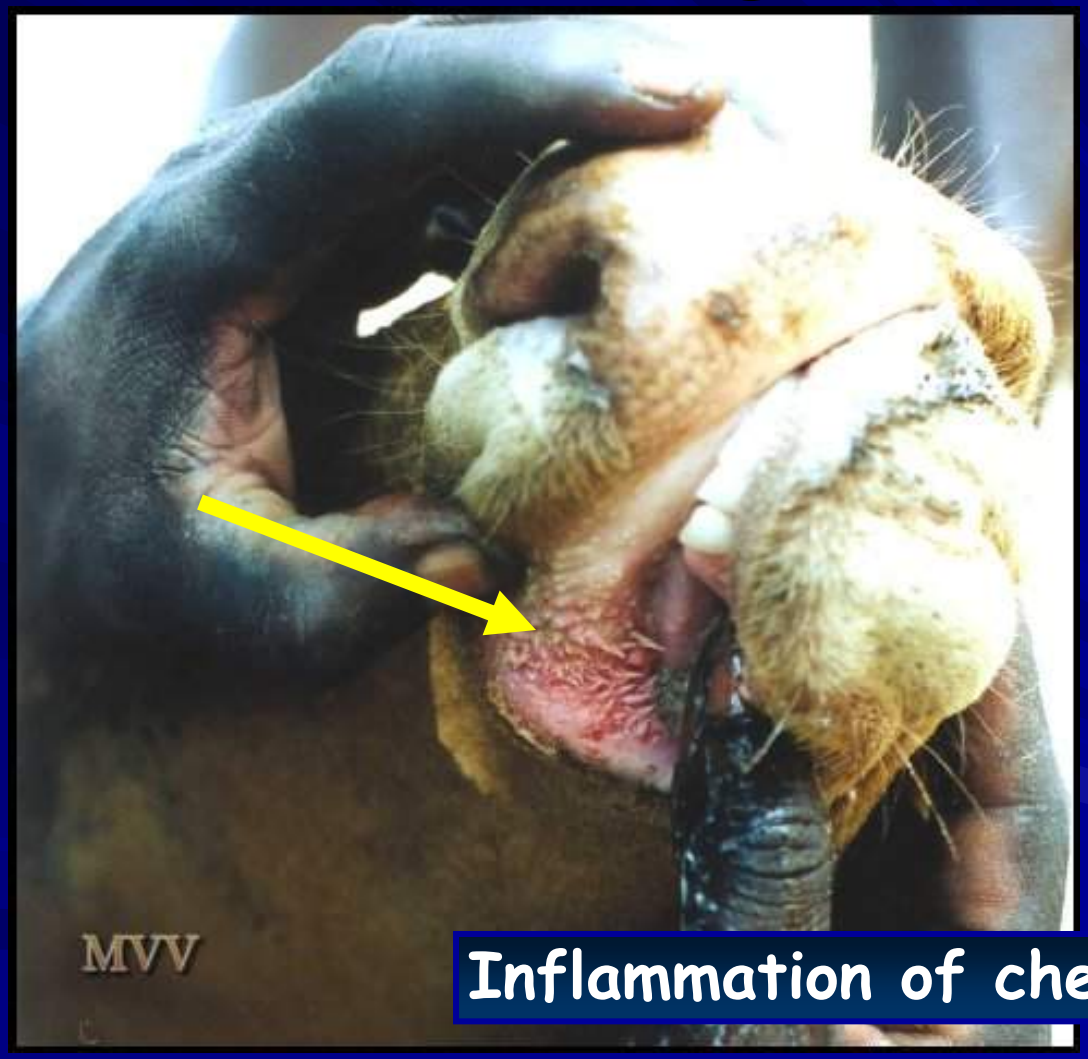
Early erosions – rinderpest or trauma ?

Clinical Signs



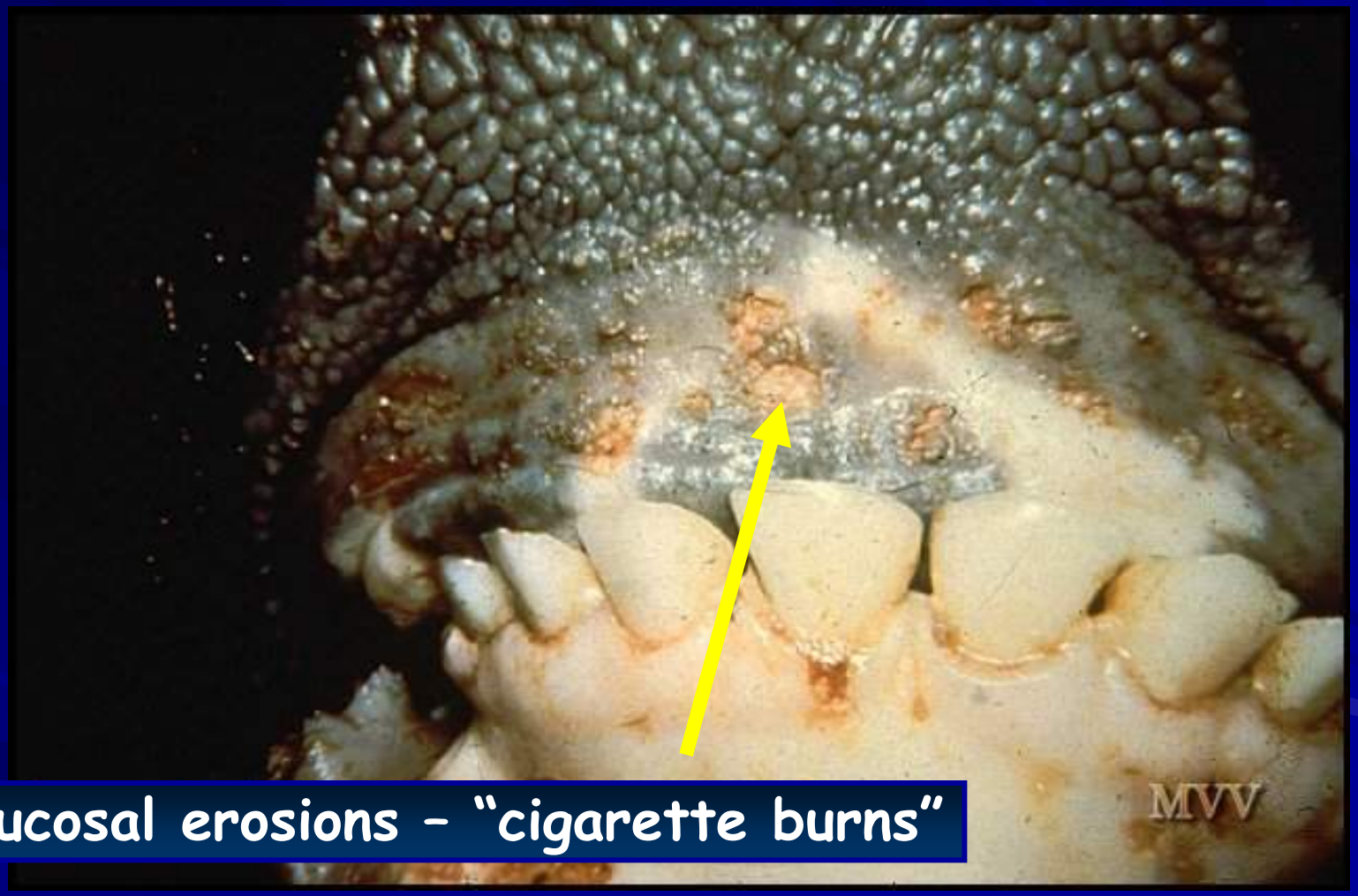
Inflammation and necrosis of cheek papillae

Clinical Signs



Inflammation of cheek papillae

Clinical Signs



Mucosal erosions – "cigarette burns"

Clinical Signs

Clinical Signs

Purulent discharges

Clinical Signs

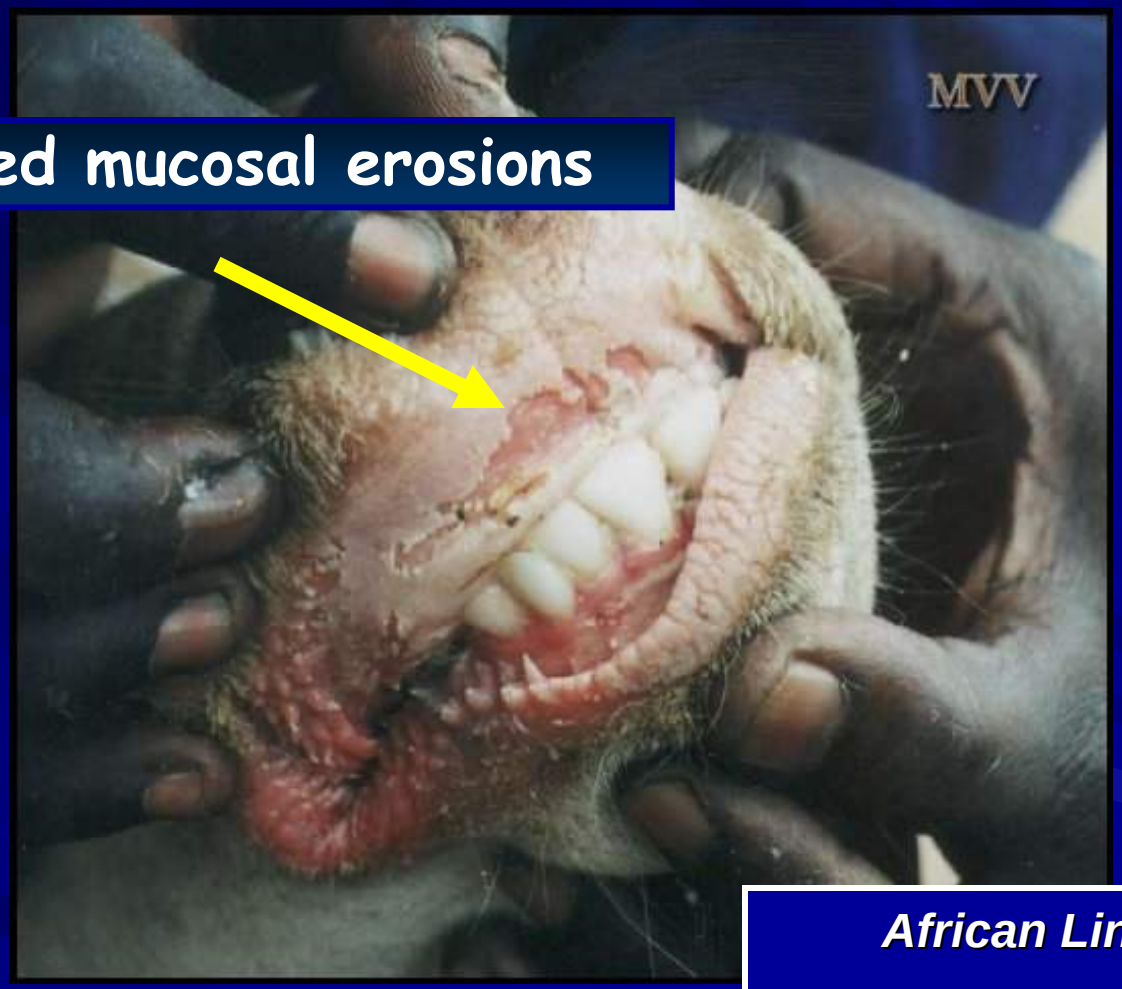
Excessive Salivation

Clinical Signs

Advanced mucosal erosions

Clinical Signs

Advanced mucosal erosions



African Lineage 1

Southern Sudan 1998

Clinical Signs

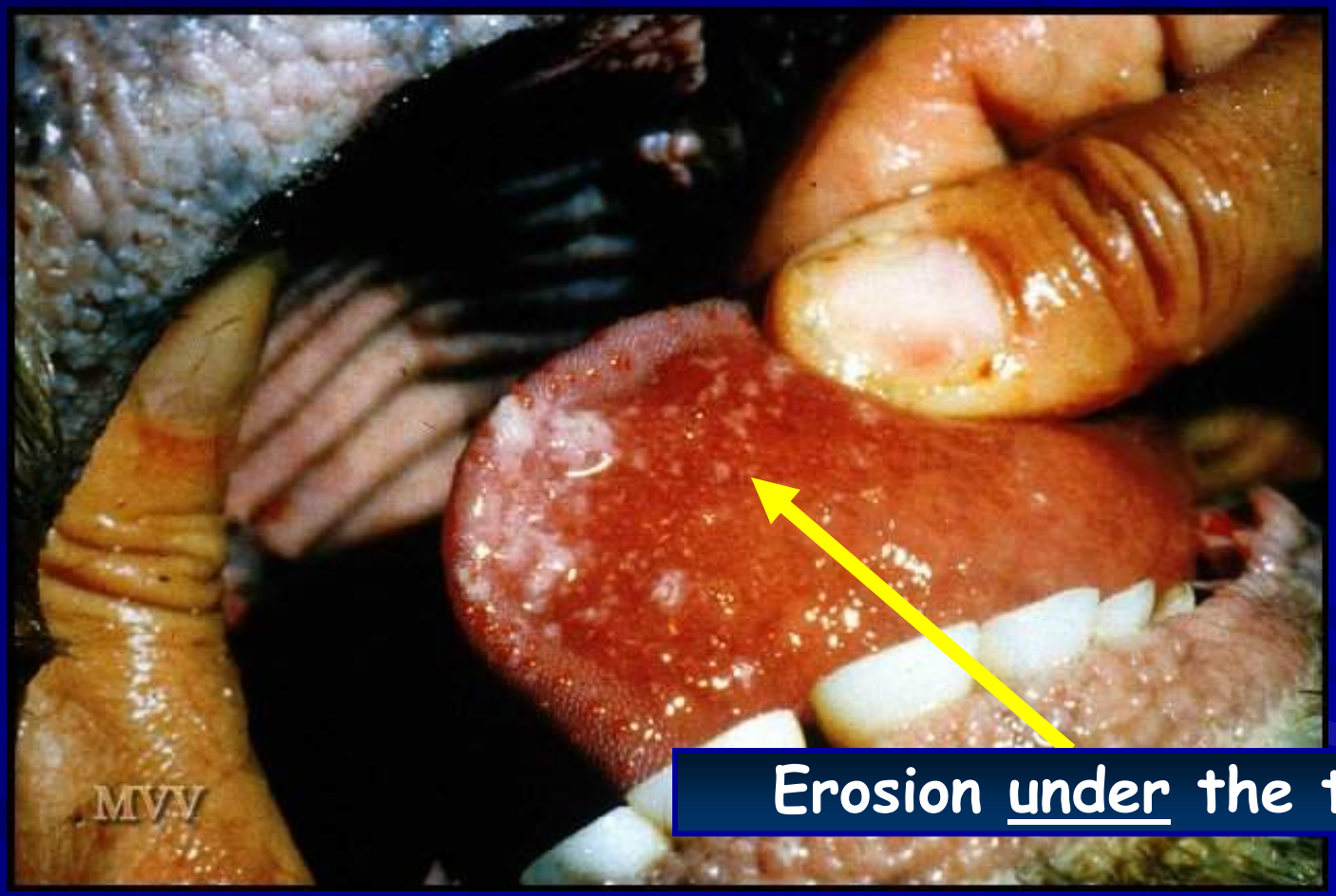
Shallow erosions in the mouth Note how these have a sharp margin

Rinderpest

Clinical Signs

Extensive mucosal erosion

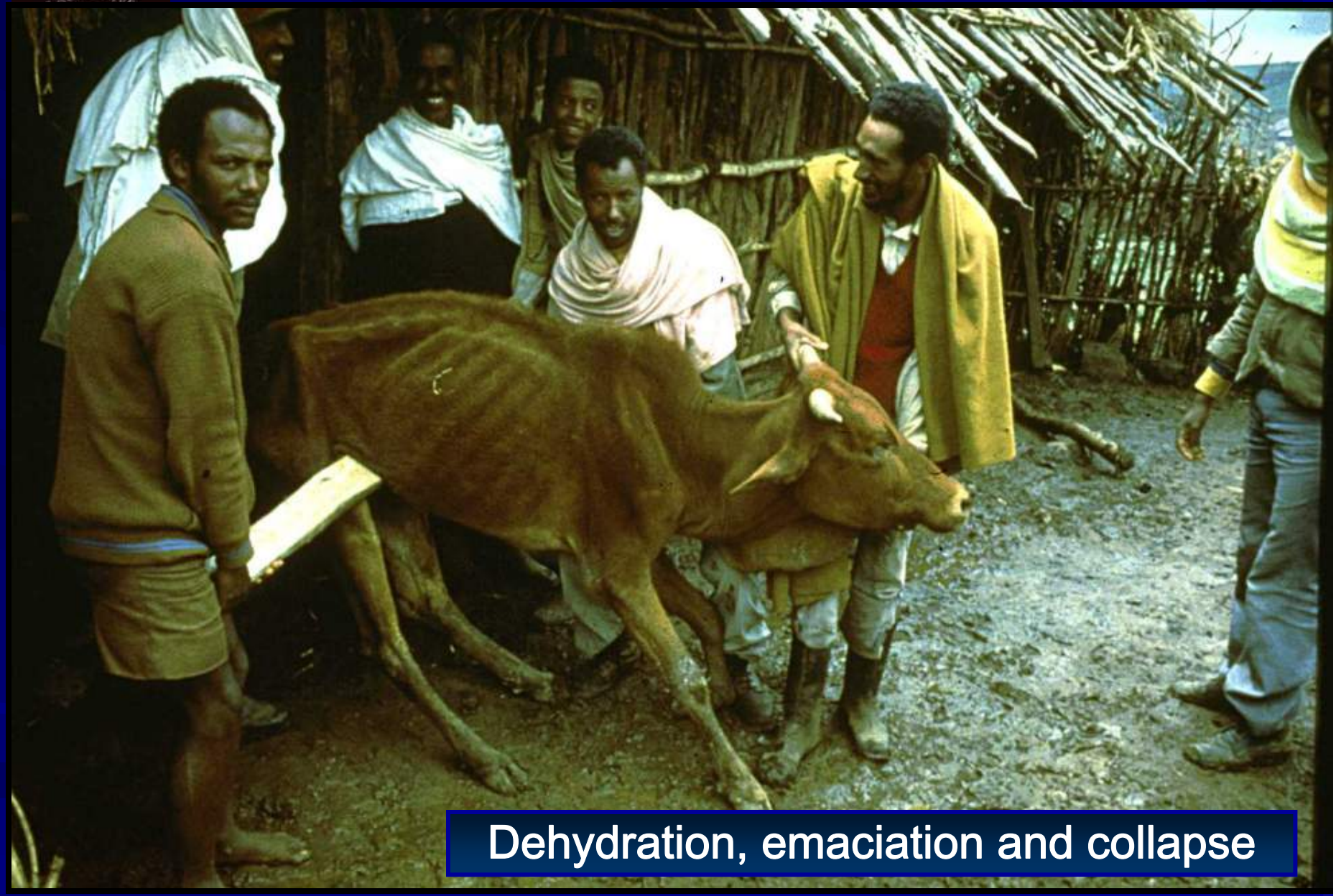
Clinical Signs



Clinical Signs

Profuse diarrhea and dysentery

Rinderpest

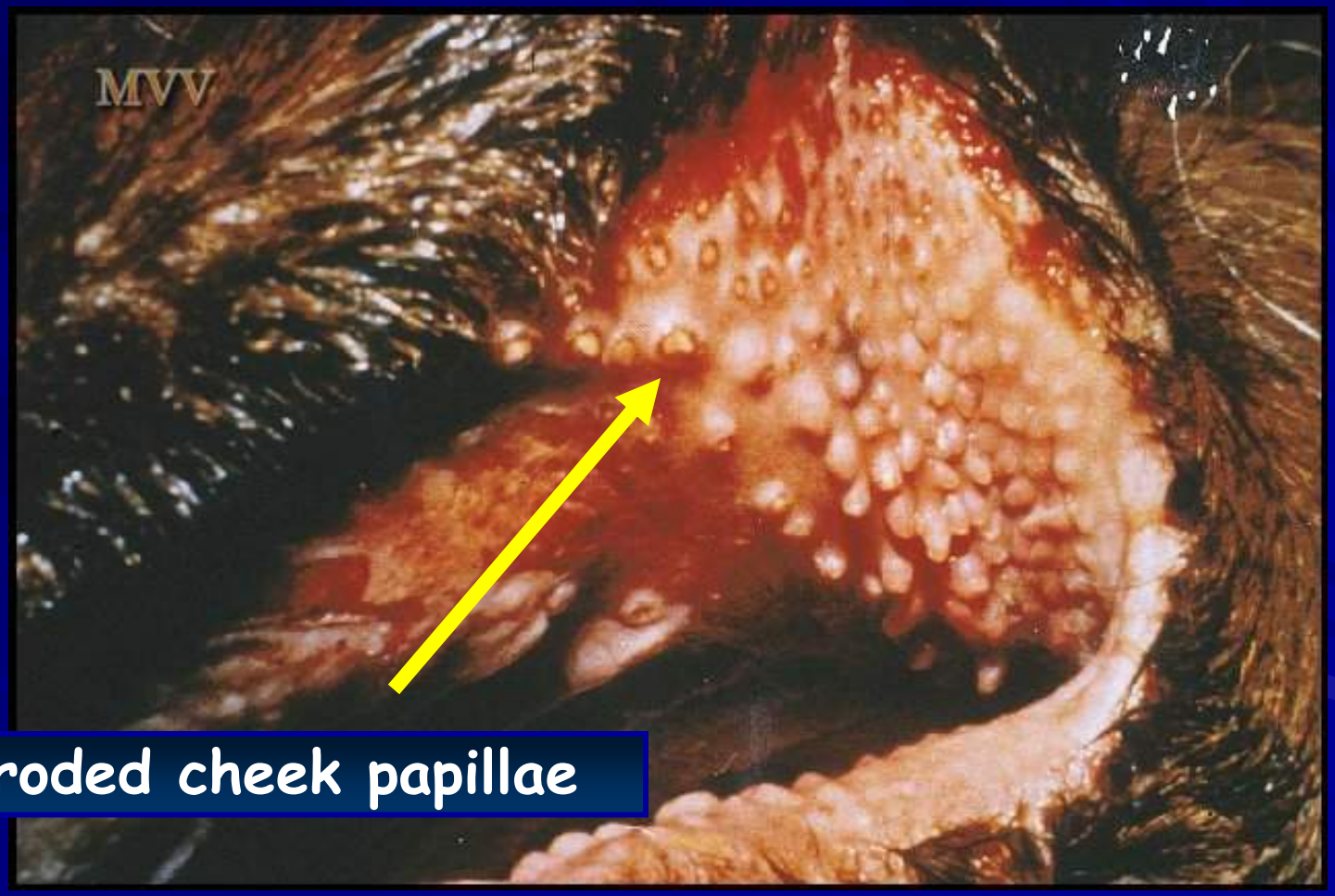

Dehydration, emaciation and collapse

Dehydration and death

Convalescence

healing mucosal ulceration

Convalescence



Convalescence

muzzle skin sloughing

Convalescence

Dried ocular discharge
and
nasal excoriation

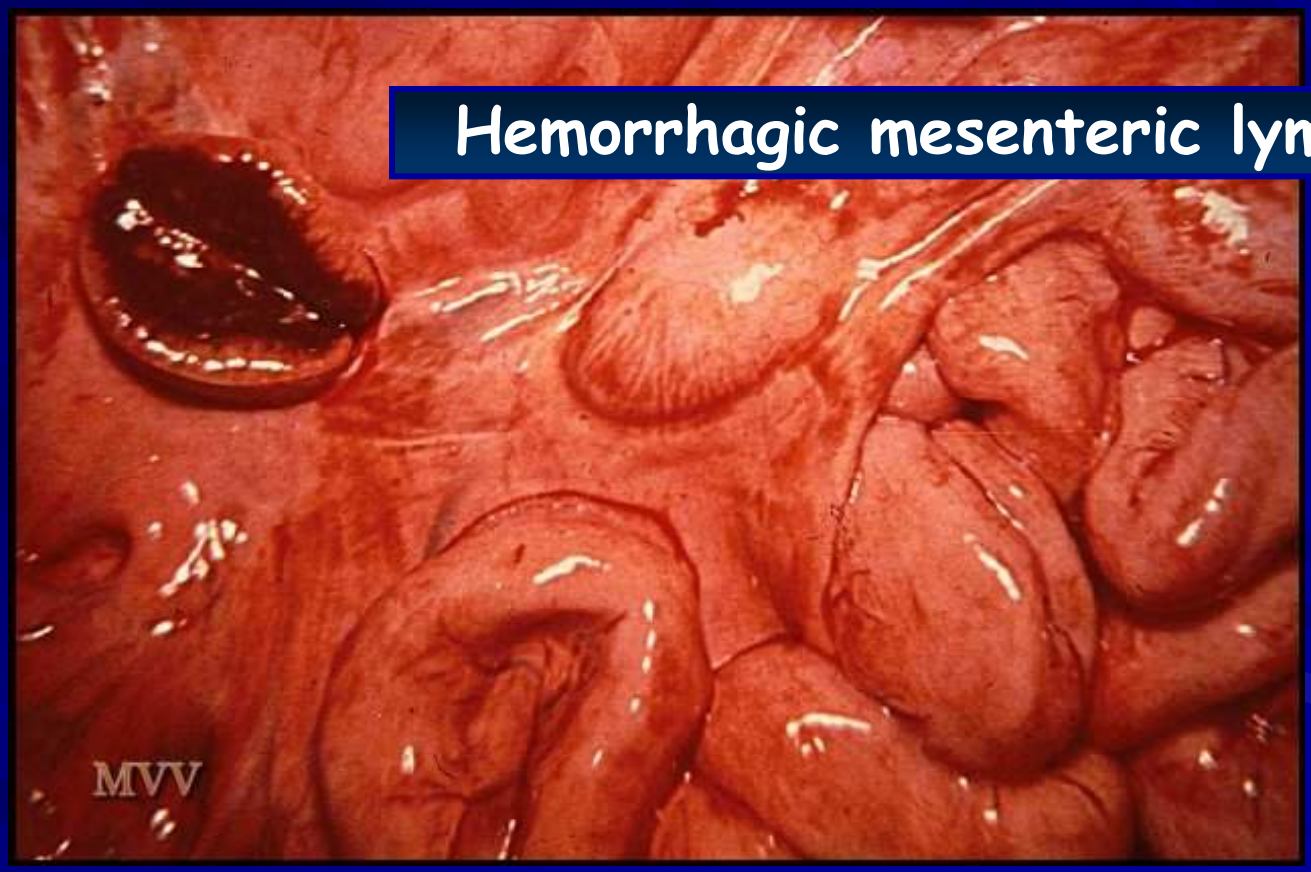
Lesions

Eroded hard palate

Lesions

Gastro-enteritis

Lesions

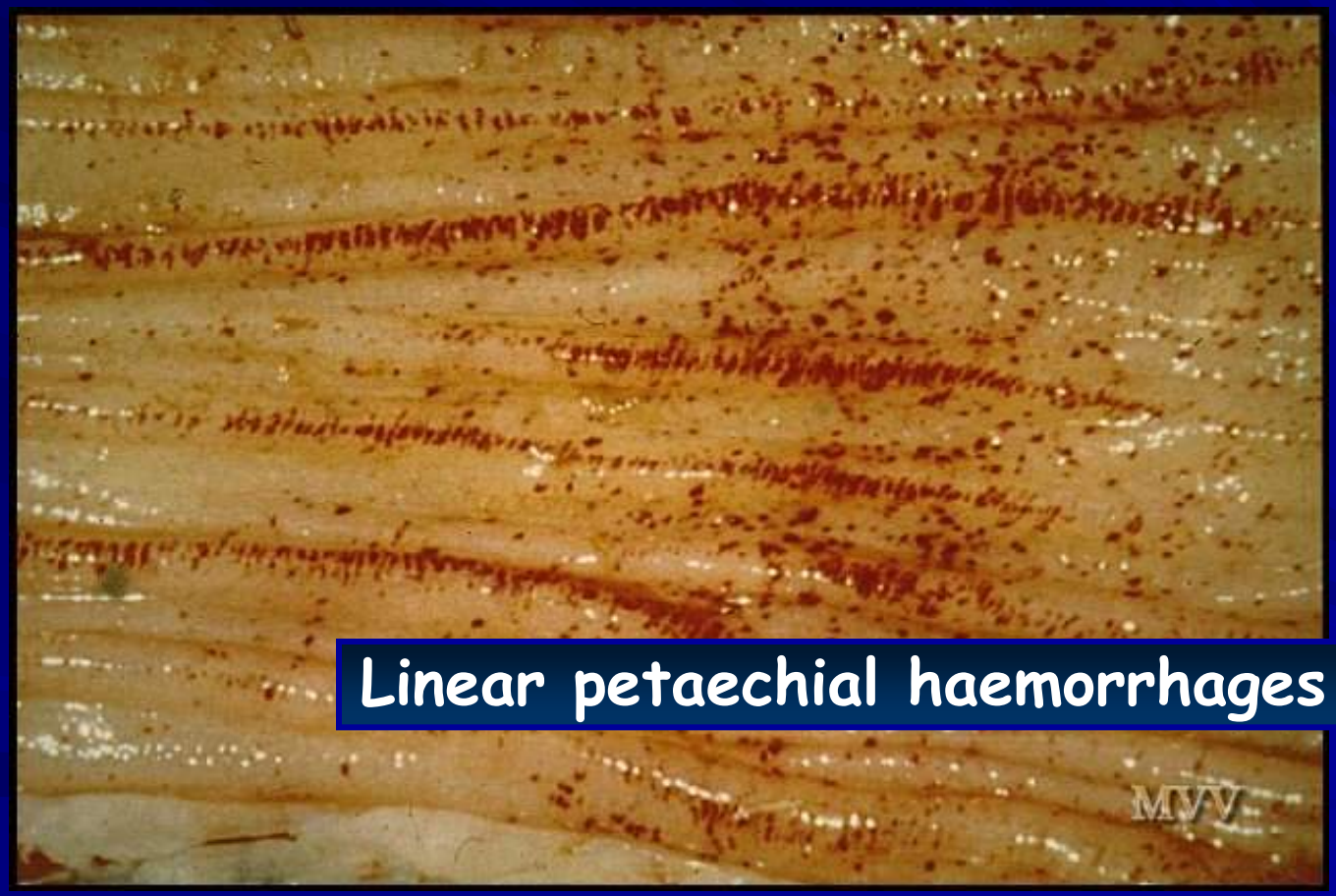


Hemorrhagic mesenteric lymph nodes

Lesions

Hemorrhagic Peyer's patches

Lesions



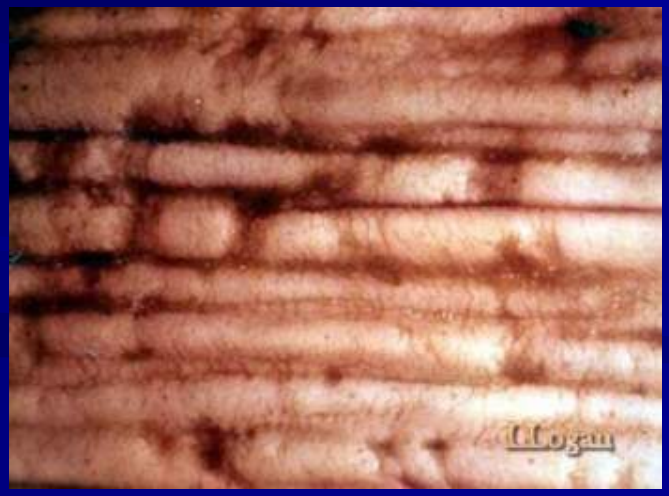
Linear petaechial haemorrhages in colon

Lesions

"Zebra striping" in the colon

Lesions

Intestinal Lesions



Terminal Rinderpest

- Epiphora, conjunctivitis
- Necrotic stomatitis
- Diarrhea

Less virulent form of Rinderpest

Clinical Signs: Kudus

- ophthalmia

Clinical Signs: swine

- Inapparent infection accompanied by modest fever
- Pyrexia, prostration, conjunctivitis, erosions of buccal mucosa, death

Clinical Signs: sheep and goats

- Clinical signs less precise that those in cattle
- Variable pyrexia and anorexia
- Inconsistent diarrhea

Transmission

- Direct Contact with infected animal
  - Respiratory and lachrymal secretions
  - Feces
  - Other body fluids
- Carriers:
  - Unknown…..wildlife?

Transmission

- Aerosol
- Vectors –tabanids*
- Ingestion
- Fomites

Transmission

There is no vertical transmission, arthropod vector, or carrier state. This makes Rinderpest virus an ideal virus to be targeted for eradication.

Diagnosis

- Samples:
  - Conjunctival Fluid
  - Intestinal contents or feces
  - Whole blood
  - Lymphoid tissue, lung, intestine
  - Serum

Diagnostic Tests

- Antigen Detection
- Antibody Detection
- Histopathology

Differential Diagnosis

- Bovine virus diarrhea
- Mucosal disease
- Infectious bovine rhinotracheaitis
- Malignant catarrhal fever
- Vesicular stomatitis
- Foot-and-mouth disease

Differential Diagnosis

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

Rinderpest - Bibliography

1. Foreign Animal Diseases (USAHA)
2. Emerging Diseases of Animals, Corrie Brown and Carole Bolin, eds. ASM Press, Washington, DC, 2000, 310pp.
3. Rinderpest, presentation to FEAD Course 2005, Knoxville Tennessee by Moritz van Vuuren
4. USDA APHIS VS, “Keeping America Free from Foreign Animal Diseases, vol 6,1997.
5. Panhandle Exercise Report, Amend, J. Burnham, S. and Waldrup, K.
6. OIE
7. FAO

Acknowledgements

Special thanks to

Linda Logan, DVM PhD, USDA

Professor Moritz van Vuuren

Ken Waldrup, DVM PhD

Robin Sewell, DVM

Kelsey Pohler- Research Assistant