Appearance of skin lesions in cattle populations vaccinated against lumpy skin disease: Statutory challenge

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ETIOLOGY

Classification of the causative agent

Lumpy skin disease (LSD) is caused by a DNA virus of the family *Poxviridae*, genus *Capripoxvirus*.

In addition to the species LSD virus the genus *Capripoxvirus* contains Sheepox virus and Goatpox virus. All these viruses are antigenically related.

Temperature:

Susceptible to 55°C/2 hours, 65°C/30 minutes. Can be recovered from skin nodules kept at –80C° for 10 years and infected tissue culture fluid stored at 4°C for 6 months.

pH:

Susceptible to highly alkaline or acid pH. No significant reduction in titer when held at pH 6.6-8.6 for 5 days at 37°C.

Survival:

LSDV is remarkably stable, surviving for long periods at ambient temperature, especially in dried scabs. LSDV is very resistant to inactivation, surviving in necrotic skin nodules for up to 33 days or longer, desiccated crusts (crosta seca) for up to 35 days, and at least 18 days in air-dried hides. It can remain viable for long periods in the environment. The virus is susceptible to sunlight and detergents containing lipid solvents, but in dark environmental conditions, such as contaminated animal sheds, it can persist for many months.

EPIDEMIOLOGY

- Morbidity rate between 5% and 45%
- Mortality rate up to 10%

Hosts

- **Cattle (*Bos taurus*, zebus, and domestic Asian buffalo) – *Bos taurus* is more susceptible to clinical disease than *Bos indicus* – within *Bos taurus,* the fine-skinned Channel Island breeds develop more severe disease, with lactating cows appearing to be the most at risk**

- **Role of wild fauna still has to be clarified – suspected clinical disease has been described in an Arabian oryx (*Oryx leucoryx*) in Saudi Arabia, Antibodies have been found in 6 of 44 wildlife species in Africa**

- **LSDV will also replicate in sheep and goats following Inoculation (non clinical cases reported!)**

Transmission

- **The principle method of transmission is mechanical (?) by arthropod vector**
  - **no specific vector has been identified to date, mosquitoes (*Culex mirificens* and *Aedes natrionus*) and flies (*Stomoxys calcitrans* and *Biomyia fasciata*) could play a major role. Hard ticks!**
- **Direct contact could be a minor source of infection**
- **Transmission occurs by ingestion of feed and water contaminated with infected saliva**
- **experimental inoculation with material from coetaneous nodules or blood.**

Sources of virus

- Viremia lasts approximately 1-2 weeks
- Skin; cutaneous lesions and crusts – virus can be isolated for up to 35 days and viral nucleic acid can be demonstrated by PCR for up to 3 months
- Saliva, ocular/nasal discharge, milk, and semen – all secretions contain LSD virus – viral DNA has been found in the semen of some bulls for at least 5 months after infection – in experimentally infected cattle LSD virus was demonstrated in saliva for 11 days, semen for 22 days and in skin nodules for 33 days

- Lung tissue; Spleen; Lymph nodes

- No carrier state

Occurrence

In the past LSD was restricted to sub-Saharan Africa but currently it occurs in most African countries. The most recent outbreaks outside Africa occurred in the Middle East 2006 and 2007 and in Mauritius 2008.

DIAGNOSIS

Clinical diagnosis

LSD signs range from inapparent to severe disease.

- **Pyrexia which may exceed 41°C and persist for one week**

- **Rhinitis, conjunctivitis and excessive salivation**

- **Marked reduction in milk yield in lactating cattle**

- **Painful nodules of 2-5 cm in diameter develop over the entire body, particularly on the head, neck, udder and perineum; between 7 and 19 days after virus inoculation**
  - **these nodules involve the dermis and epidermis and may initially exude serum**
  - **over the following two weeks they become necrotic plugs that penetrate the full thickness of the hide ('sit-fasts')**

- Pox lesions may develop in the mucous membranes of the mouth and alimentary tract and, in trachea and lungs, resulting in primary and secondary pneumonia
- Depression, anorexia, agalactia and emaciation
- All the superficial lymph nodes are enlarged
- Limbs may be edematous and the animal is reluctant to move
- Nodules on the mucous membranes of the eyes, nose, mouth, rectum, udder and genitalia quickly ulcerate, and all secretions contain LSD virus
- Discharge from the eyes and nose becomes mucopurulent, and keratitis may develop

Lesions

- Nodules involving all layers of skin, sub-cutaneous tissue, congestion, hemorrhage, edema, vasculitis and necrosis

- Enlargement of all lymph nodes lymphoid proliferation, edema, congestion & hemorrhage

- Pox lesions of mucous membrane of the mouth, the pharynx, epiglottis, tongue

- Pox lesions of the mucous membranes of the nasal cavity

Differential diagnosis

- **Severe LSD is highly characteristic, but can be confused with**
- **Pseudo LSD/herpes mammillitis (BHV 2)**
- **Bovine papular stomatitis (Parapoxvirus)**
- **Pseudocowpox (Parapoxvirus)**
- **Vaccinia virus and Cowpox virus**
- **Dermatophilosis; Insect or tick bites; Besnoitiosis; Rinderpest (?); Demodicosis**
- ***Hypoderma bovis*; Urticaria**

Medical prophylaxis

- **Homologous live attenuated virus vaccine: − Neethling strain: immunity conferred lasts up to three years**
- **Heterologous live attenuated virus vaccine: − sheep or goat pox vaccine, but may cause local, severe, reactions**

− follow manufacturer's instructions; not advised in countries free from sheep and goat pox

Serological tests

- **Virus neutralization – cross reacts with all capripoxviruses**

- **Indirect fluorescent antibody test: cross reaction with parapoxviruses**

- **Capripox antibody ELISA**

- **Western blot: highly sensitive and specific but expensive and difficult to perform**

Statements or work hypothesis

- **Vaccines that are used for farm animal in veterinary medicine are primarily dedicated to an economic purpose**
- **prevention might be expected: (or/and) decrease of deaths; to preserve animal's economic values**
- **alleviation of clinical manifestations alone is not a sufficient reason to use vaccines in veterinary agricultural medicine**

The ultimate goal of a vaccine therefore should be zero clinical signs.

LSD; numbers of vaccinated and sick/destroyed cows.

date	Sick/total (%)	Vaccinated/Destroyed
P/ June1989	64/633 (10.1)	0/633
EZ/ July 2006	212/605 (35.2)	0/213
S/7 Aug 2006	3/130 (2.3)	130/3
K/V Aug 2006	2/140 (1.4)	140/2
Al/ June 2007	49/547 (9.8)	547/49
OH/ Aug 2007	144/325 (44.3)	246/144
OH/ Aug 2007	43/500 (8.6)	500/43
NA/ Sep 2007	99/260 (38)	260/99
Er/ Sep 2007	97/235 (41.3)	235/97
Er Nov 2007	43/520 (8.2)	520/43
HS/ Oct 2007	27/270 (10)	270/27
D/ Nov 2007	2/800 (0.3)	800/2
IM/ Sep 2007	4/880 (0.4)	880/4

PCR results of specimens taken from vaccinated animals.

sampling date	Pos/tested animals	Number of vaccination
16 June 2007	6/6	1
25 July 2007	2/2	3
22 July 2007	1/1	1
31 July 2007	6/6	3
19 July 2007	1/1	2
25 July 2007	3/3	3
30 August 2007	2/2	3
30 October 2007	3/3	4
29 July 2007	1/1	1
09 August 2007	1/1	3
09 August 2007	0/2	3
12 August 2007	1/1	3
13 August 2007	2/2	3
14 October 2007	6/6	4
Five different sites	0/6	2–3

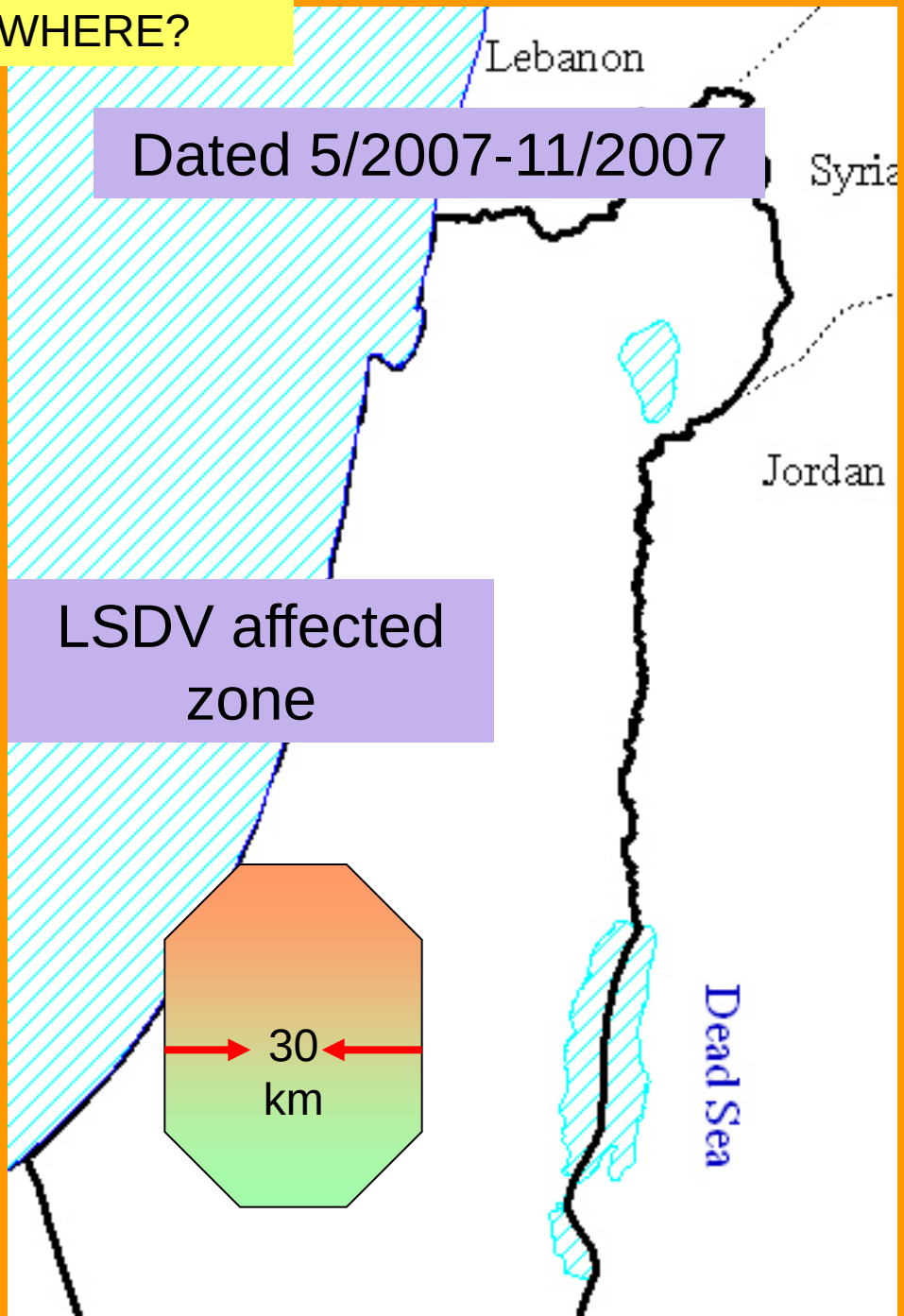
Summary of total numbers of vaccinated and unvaccinated cattle and the proportions of cows with skin lesions following in-field LSDV exposure.

	Number of cattle with LSD (pro; 95% CI)
Unvaccinated cattle ***N*= 1238**	**276**
	0.22 (0.2; 0.25)
Vaccinated cattle ***N*= 4607**	**513**
	0.11 (0.1; 0.12)

Summary of total numbers of vaccinated dairy and beef cattle populations and the proportions of cows with skin lesions following in-field LSDV exposure.

	Number of cattle with LSD (pro 95% CI)
Dairy (*N*= 3517)	146
	0.042 (0.04; 0.05)
Beef (*N*= 1090)	367
	0.337 (0.32; 0.38)

WHERE?

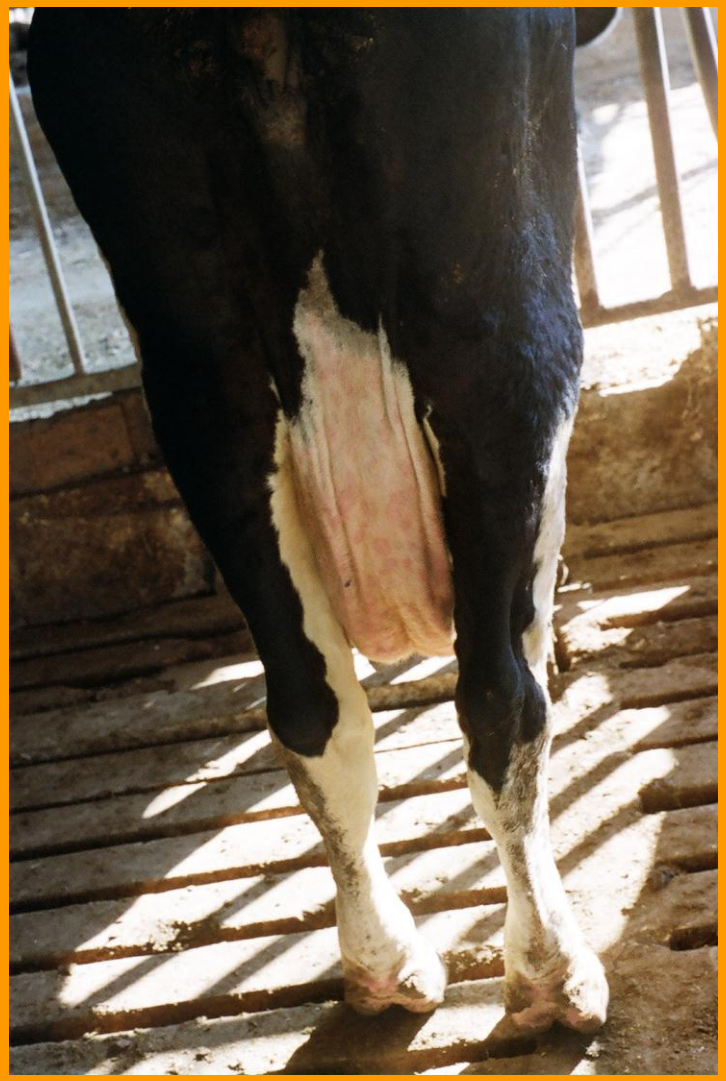

Lebanon
Syria
Jordan
Dead Sea
Dated 5/2007-11/2007
LSDV affected zone
30 km

Cow, flank. Multiple skin papules and nodules, some with necrotic centers

Cow, perineum and udder. Multiple skin macules & papules.

Cow, flank. Numerous skin papules.

Cow, flank. Multiple skin. Papules & an enlarged prefemoral lymph node.



LSD

This “udder form” might be confused with PLSD as well since in some lesion BHV2 could be demonstrated (together with capripox or alone!).

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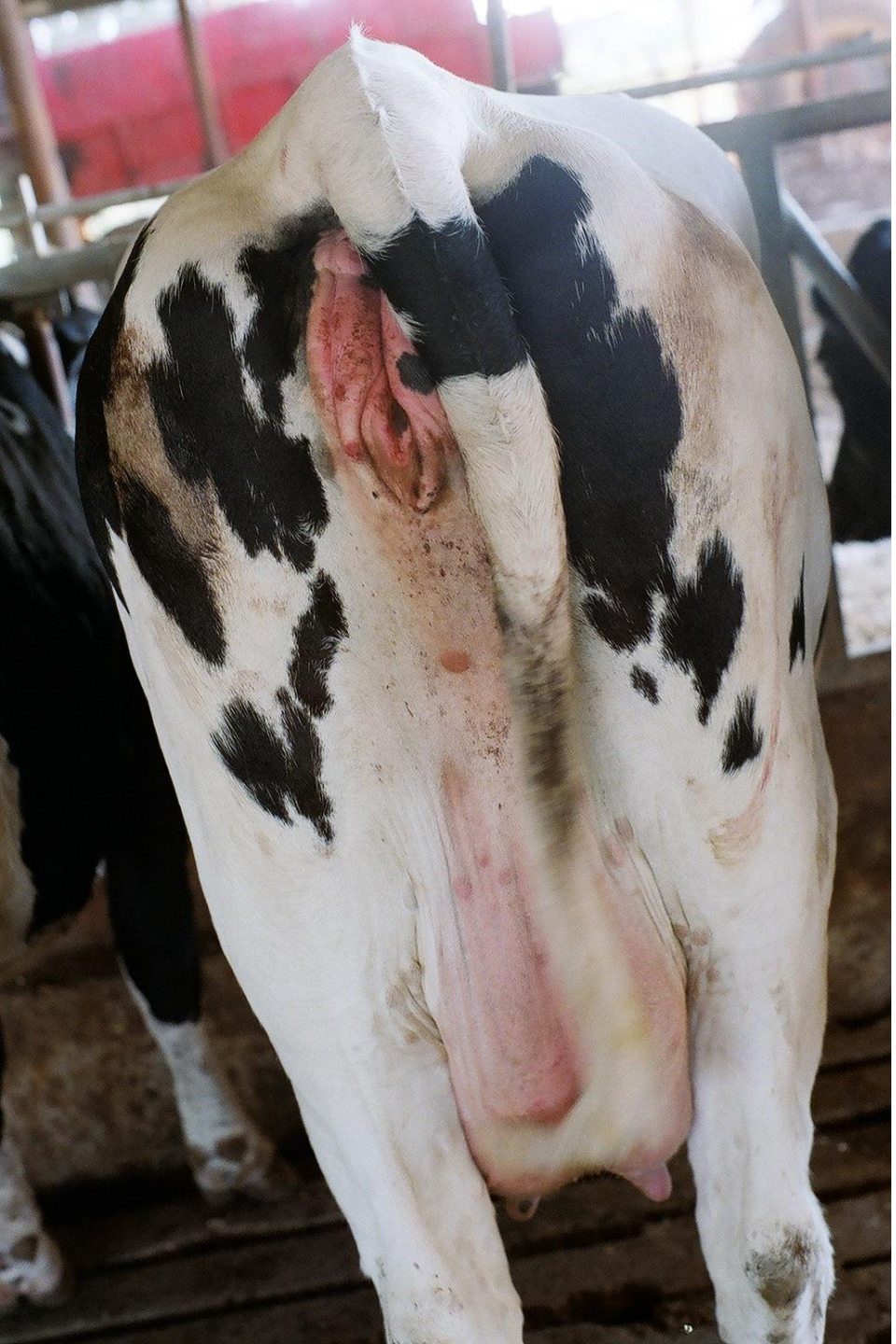
Some clinician might think of bovine herpes mammallitis. Wrong.

A typical LSD. Important, look at the prefemoral lymph node

A typical LSD. Again some lesions resemble BUHM

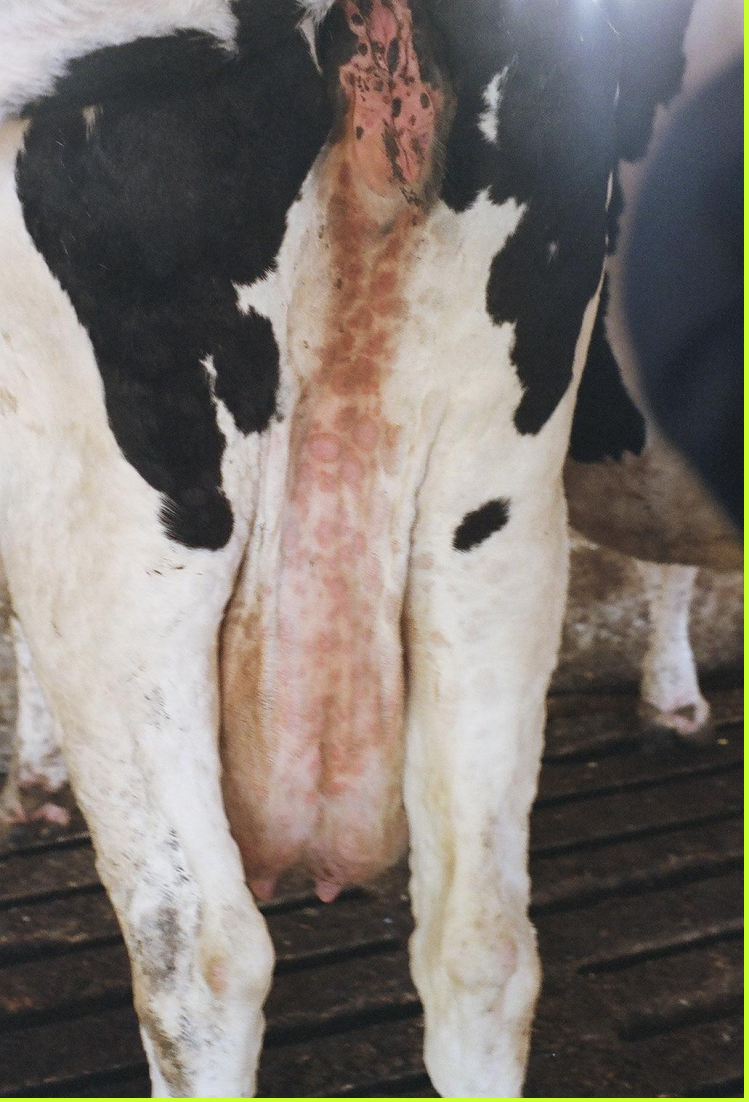
See image 1

A typical LSD. Important, look at the prefemoral lymph node



A typical LSD.

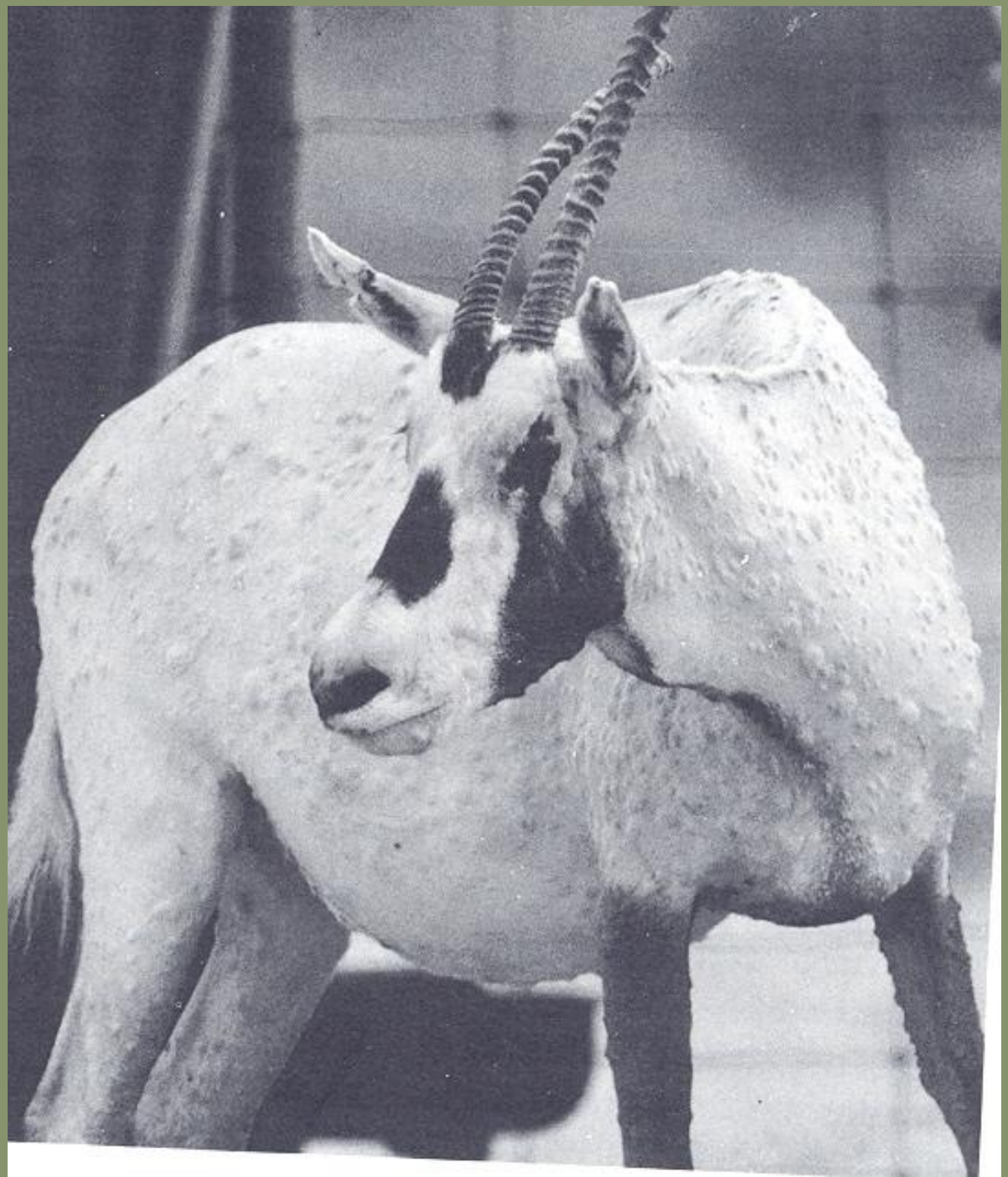
A leave of a red-spot surface (healing process; the age of this quasi-healed lesion is from 2 to 3 weeks). This lesion resemble the hairless lesion of PLSD.



This is not BUHM this is LSD!

Progressed to a well developed intradermal nodule very hard on touch

A leave of a red-spot surface (healing process; the age of this quasi-healed lesion is from 2 to 3 weeks). This lesion resemble the hairless lesion of PLSD.



Some aspects of pseudo lumpy skin disease. Note some resembled the real slough off process of LSD

A clinical aspect of PLSD lesion

A clinical aspect of PLSD lesion. A close observation of a lesion resembling the initial stage of the real LSD

A clinical aspect of PLSD lesion. This hairless lesion resembles the healing stage of LSD

A clinical aspect of PLSD lesions. Note also the general clinical condition of the fur which is not smooth, could be confounded with the very initial miliary stage of LSD.

SA-MCF head and eye form

LSD “head and eye form”

???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SA-Cutaneous MCF

Dermatophilosis