# ERYTHROPOIETIC PROTOPORPHYRIA IN LIMOUSIN CALVES

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## Porphyria – background

Porphyrins are basic components of enzymes that contain haem, including haemoglobin, the cytochromes, catalase and many peroxidases.

Porphyrias are a group of acquired (liver disease) or inherited (dominant or recessive) disorders of certain enzymes in the haem biosynthetic pathway. There are eight enzymes in the pathway and defects in any one can lead to some form of porphyria.

Both hepatic and erythropoietic forms exist and disease has been reported in man, cattle, pigs and cats. Hepatic porphyrias are characterised by acute neurological attacks, while the erythropoietic forms present primarily with skin problems.

## Bovine Erythropoietic Protoporphyria (BEPP)

This is an hereditary defect, recorded in both cattle and man, resulting from a deficiency of ferrochelatase – the terminal enzyme catalyzing the insertion of ferrous ion into protoporphyrin IX to form haem.

Deficiency results in elevated concentrations of protoporphyrin in erythrocytes and tissues and inadequate production of haemoglobin. Protoporphyrin is a photodynamic agent and BEPP is characterised by signs of photosensitisation.

In man it is thought to be associated with an autosomal dominant gene with variable penetrance whereas in cattle an autosomal recessive gene is thought to be involved.

Limousin is the main breed affected although it has been reported in Blonde d'Aquitaine

## Occurrence

First reported in the USA in 1977. Reported in France (1991) and Australia (1992).

The condition had rarely been reported in the United Kingdom before 2007. However, following the diagnosis of BEPP in a Limousin calf in the summer of 2007 at Veterinary Laboratories Agency (VLA) Penrith Regional Laboratory, many more cases have come to light, in both England and Wales.

## Genetic testing

The North American Limousin Foundation (NALF), Canadian Limousin Foundation and Australian Limousin Breeders Association all have PCR-based testing methods. This relies on amplification of the mutant ferrochelatase gene. In North America, for progeny to be eligible for the NALF herdbook, AI sires must have a genotype for protoporphyria ("proto") on file. There is no equivalent testing programme in the United Kingdom.

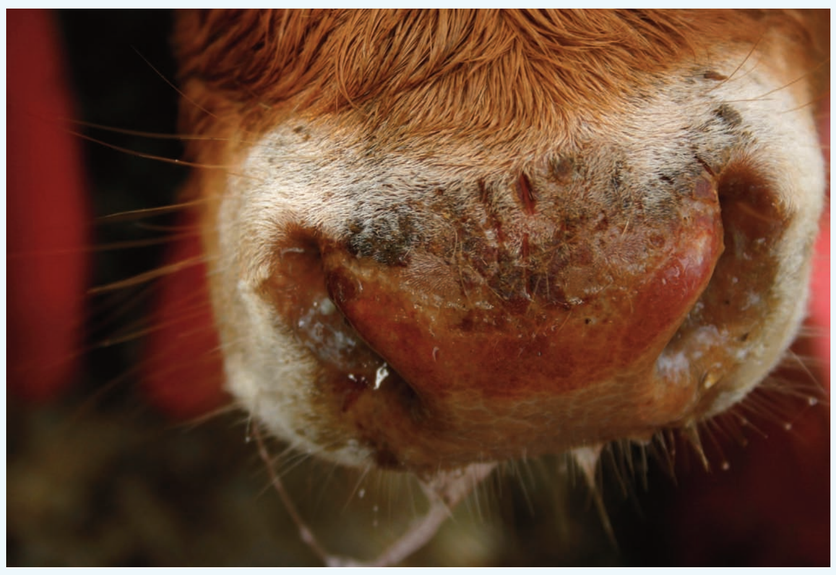

FIG 1. Severe dermatitis with crusting of nares

FIG 2. Severe thickening and distortion of ears

## Signs

- Protoporphyrin has photoreactive properties in dermal capillaries, inducing acute cytolysis, resulting in exudative dermatitis.
- Signs of disease include erythema, ulceration and scab formation of nares, ears, dorsal midline and perineal region including teats. Sub-lingual ulceration also reported. (Figs 1-6)
- Ear scratching, nose licking and an aversion to sunlight shown by affected calves. Signs resolve on housing
- Recurrent epileptic seizures/collapse have been reported in some cases, (aetiology uncertain-? accumulation of gamma-aminolevulinic acid)

## Diagnosis

- Breed predisposition (Limousin). Signs of photosensitisation
- Total plasma porphyrin concentration elevated (<10nmol/l increased to 100's nmol/l)
- Total erythrocyte porphyrin shows a similar rise
- Characteristic deposition of pigment, resembling lipofuscin, in liver in hepatocytes and Kupffer cells. Some deposits have characteristic Maltese cross appearance when seen in polarised light.(see Figs 6-7)

## Differential diagnosis

1. Primary photosensitisation due to ingestion of photodynamic agent e.g. hypericin in the plant St. John's Wort (Hypericum perforatum).
2. Photosensitisation secondary to severe liver damage resulting in excess levels of the photodynamic agent phylloerythrin (formed from chlorophyll).
3. Malignant catarrhal fever.
4. Bluetongue (BTV-8).
5. Bovine congenital porphyria – see discoloured (pink) teeth, anaemia and porphyrin in urine. Pigments fluoresce in UV light. Signs present at birth.
   • Simple recessive inheritance affecting many breeds including Shorthorn, Ayrshire, Friesian.

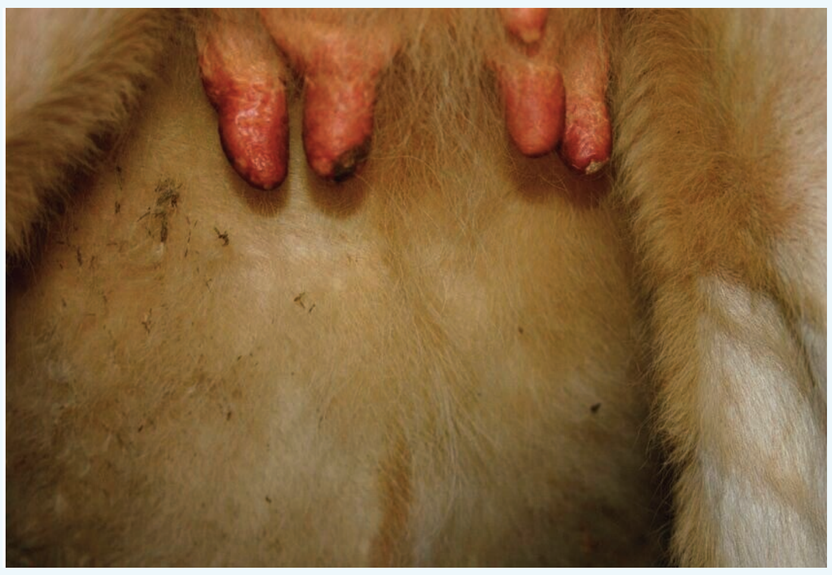

Fig 3. Teat erythema

Fig 4. Sub-lingual ulceration

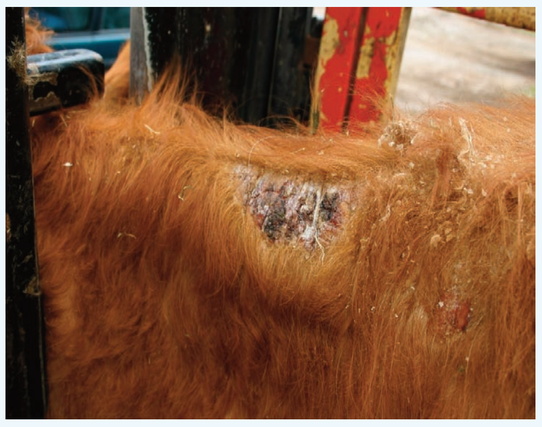

Fig 5. Lesion on back in dorsal midline

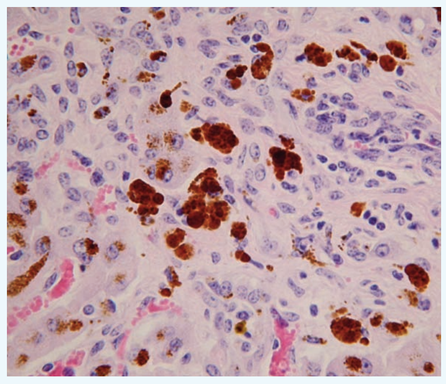

Fig 6. Pigment deposition in liver

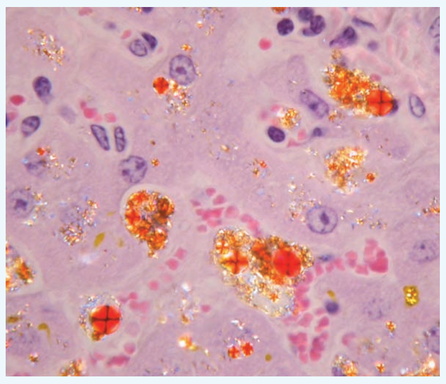

Fig 7. "Maltese cross" appearance. Polarised light. Liver

## Conclusion

The incidence of this condition in the UK is unknown. Initiation of a scheme by the The British Limousin Cattle Society, along the lines of those adopted in other countries, would provide useful data on the true incidence of this condition, and may ultimately prove essential.

Recent experience within the Veterinary Laboratories Agency would suggest that the condition is more common than previously suspected. Even without the adoption of a national scheme it is hoped that increased practitioner familiarity with the condition will result in a more accurate estimation of its prevalence in the United Kingdom.

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