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Brief Communication

A CASE OF BOVINE OCHRONOSIS

Ochronosis is a sequela to alcaptonuria — an inherited metabolic disease in man, which to our knowledge has not been described in animals. The background of the disease is as follows (*O'Brien et al.* 1963, *Hollander* 1966, *Wolman* 1969, *Jaffe* 1972).

When tyrosine and phenylalanine are metabolized, homogentisic acid is formed and further degraded through the mediation of homogentisic acid oxidase. Inherited abscence of this enzyme results in excretion of homogentisic acid in urine — alcaptonuria and its sequelae — ochronosis (progressive deposition of brownish black pigment derived from polymerized homogentisic acid, particularly in cartilage), and ochronotic spondylosis and arthropathy (progressive degeneration of cartilage in association with ochronosis). Ochronosis may also be secondary to chronic phenol application. The pigmentation is particularly seen in costal, laryngeal, tracheal and bronchial cartilage, and in articular cartilage, intervertebral discs and cartilage plates of the vertebral epiphyses. The pigment is not characterized chemically and does not give any specific histochemical reactions. Fat and iron stains give negative reactions. The differentiation from melanin is difficult or impossible. The fact that the pigment is visible without staining and has a very characteristic distribution makes confusion unprobable. Alcaptonuria is diagnosed by determination of homogentisic acid in urine.

Material and methods

In February 1977 a 9 months old bull of the Swedish Friesian cattle (slaughter weight 152 kg), normally developed without any signs of disease, was slaughtered on a farm in southern Sweden after an accident (strangulation). At inspection, except signs of strangulation, brownish black discolouration of the cartilage of the hyoid bone, the large bronchi and some coccygeal vertebrae was noticed, whereas other cartilaginous tissues had a normal appearance.

After fixation in a 10 % aqueous solution of formaldehyde samples from the affected tissues and from the heart with the aorta were sent to the National Veterinary Institute for histopathology. Sections were stained with Scarlet Red, H. & E., PAS, Masson melanin stain, Nile blue stain according to *Lillie* (1956) and Pearl's iron stain.

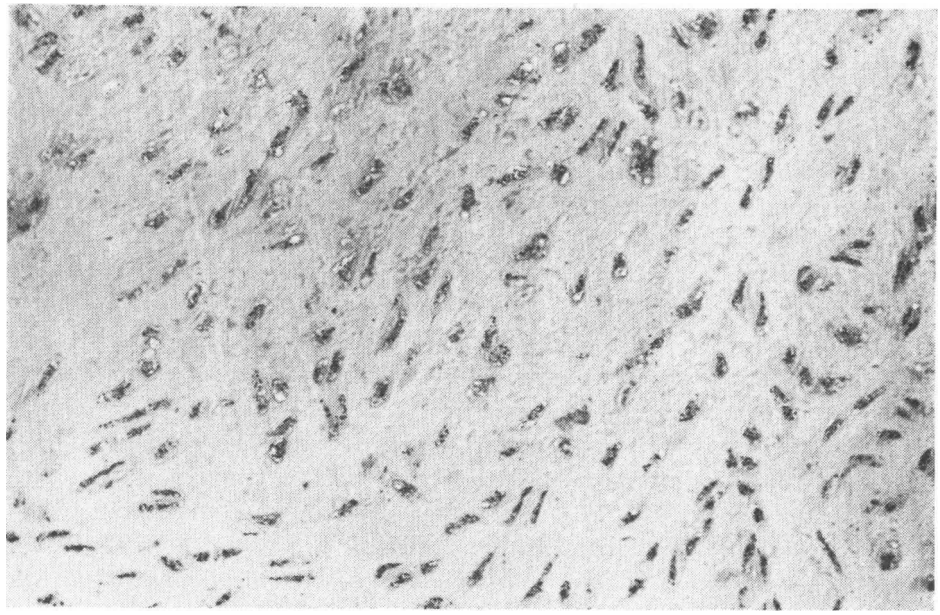

Figure 1. Cartilage of the hyoid bone. Dark pigmentation of the chondrocytes. Scarlet Red, 150 ×.

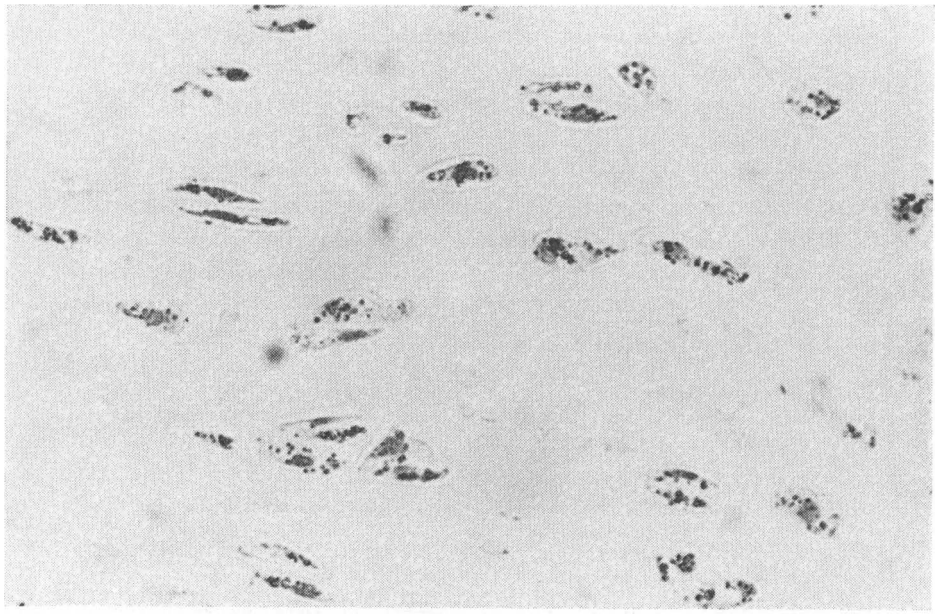

Figure 2. Cartilage from a bronchus. Dark granules in the chondrocytes. H. & E., 500 ×.

Results and discussion

The pigmentation of the cartilage tissues examined is almost entirely confined to the cytoplasm of the chondrocytes, partly as a diffuse yellowish brown discolouration, partly as dark brown

granules (Figs. 1 and 2). In the cartilage of the hyoid bone, the intervertebral disc and the cartilage plate of the vertebral epiphysis, the pigmentation is more pronounced peripherically with the chondrocytes heavily loaded with granules. Scattered granules are also seen in the fibrocytes and matrix of the surrounding perichondrium. The pigmentation of the bronchial cartilage is evenly distributed. The pigment does not react with the iron, fat and PAS stains used. With Nile blue there is a faint greyish green tinge in the cytoplasm of the chondrocytes. Acetone treatment does not affect the dark brown colour of the granules whereas the cytoplasm almost completely loses its colour. In Masson stain the cytoplasm is light brown and the granules black, which almost entirely disappears after bleaching with hydrogen peroxide. No pigmentation can be shown in the heart and aorta.

Since no material for determination of homogentisic acid in urine has been available, the diagnosis of alcaptonuria remains an open question. There is no evidence of chronic phenol exposure, e.g. from carbolic acid dressings or the like. Ochronosis in man is a progressive pigmentation, which is not manifested until middle life. The present animal was in puberty which might explain the pigmentation in only very few, though typical locations. No articular cartilage was available for examination in our case. In man, the pigmentation is said to start in the matrix, followed by the appearance of granules in the chondrocytes (*O'Brien et al., Jaffe*). In our case, cytoplasmic granules were prevalent. There was a qualitative agreement in histochemistry between ochronosis in man and the pigmentation of our case.

In conclusion, the present case seems to represent an animal example of ochronosis in an early stage, judged from a purely clinical and pathoanatomical point of view.

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