Case report

Bovine renal lipofuscinosis in a Tanzanian crossbred yearling male calf: A case report

ABSTRACT

Aim: To report a rare case of bovine renal lipofuscinosis (BRL) which was incidentally encountered at necropsy.
Presentation of case: In June 2023 an yearling male calf was found dead in one of the dairy cattle farms in Mbeya city, Tanzania; after being sick for about a week. The owner requested for a necropsy service in order to establish the cause of death of the animal. Necropsy revealed significant gross pathological changes on a liver which was cooked-like, shrunken, with flabby consistence and large pale necrotic foci. Furthermore, dark blue discoloration of both kidneys with normal morphology was evident. Based on history and gross pathological findings, the animal was diagnosed to have died of acute hepatitis. Differential diagnosis for the kidneys discoloration included hemachromatosis, renal hemosiderosis, BRL, and melanotic renal cell carcinoma (MRCC). After ruling out hemachromatosis, renal hemosiderosis, and MRCC in the list of possible causes of the kidneys discoloration based on lack of gross pathological findings particularly hepatic fibrosis, pallor, and a mass of tumour tissue on the kidneys which are characteristic for hemachromatosis, renal hemosiderosis, and MRCC, respectively; the cause of the kidneys discoloration was diagnosed to be BRL.
Discussion: In this necropsy, history and gross pathology suggested that the animal's death could be attributed to acute hepatic failure which is one of the sequelae of acute hepatitis. The kidneys discoloration was not considered as an attributing factor to the animal's death because with exception of the discoloration, the kidneys had no gross pathological changes. Moreover, to date there is no report of a clinical disease in cattle which is associated with BRL.
Conclusion: A case of BRL reported here was an incidental finding at necropsy, it is not associated with the animal's death.

Keywords: *Dark blue discoloration, black kidneys, hemachromatosis, renal hemosiderosis, melanotic renal cell carcinoma*

1. INTRODUCTION

Bovine renal lipofuscinosis (BRL) is an incidental finding in cattle at slaughter [1, 2]. It is associated with brown to black discoloration of the kidneys, which are condemned as unfit for human consumption [1, 3]. The main feature is a brownish to dark brown discoloration of the kidneys in an apparently healthy animal [2, 4]. The discoloration involves the entire organ, and both kidneys are equally affected to the same extent. The extent of discoloration varies. In some instances it may be so intense that the kidneys take a dark blue, glistening appearance [4]. This discolouration has given rise to the more common name "black kidney disease" [2, 4, 5].

BRL has been reported as incidental findings in slaughter cattle for more than a century [3]. Initially, some studies identified accumulation of melanin pigment as the cause of this condition. Others identified accumulation of hemosiderin as the cause of the condition, and others identified accumulation of lipofuscin pigment to be the cause of the condition [3]. Since the 1960s several studies further classified this pigment as lipofuscin based on its staining and ultrastructural properties [2, 3], a view which is currently generally accepted.

Generally, lipofuscin pigment comes from the degradation of proteins and lipids that accumulate within cells especially cells of the heart [2, 6, 7, 8], liver [2, 6], neurons [2, 6, 7, 8, 9], kidneys [6], dermal tissue [6, 8, 10] and skeletal muscle fibers [7] as part of the normal cellular aging process [2, 8, 10] or in association with multiple diseases or disorders [2].

According to reports of epidemiological and genealogical studies, the disorder has a genetic etiology with simple autosomal recessive inheritance in the Danish Red and Danish Holstein breeds [1, 3], but with incomplete penetrance of the genotype in Danish Holsteins [1]. The disorder has been reported in Danish Red, Danish Holstein, crossbred cattle [1, 3], Danish Jersey, Danish Red Holstein, Finnish Ayrshire, Norwegian Red, Jutland cattle, Summerntaler, Swiss Brown, Grauviel, Highland cattle, Danish Gelbvieh, Dexter, Salers, Aberdeen Angus, Galloway, Hereford, Piemontese, Blonde d'Aquitaine, Danish Shorthorn, Danish Charolais, Limousine, and Belgian blue breeds of cattle [1]. This paper reports a case of BRL encountered at necropsy of a crossbred yearling male calf in a dairy cattle farm composed of crosses of Friesian, in Mbeya city, Tanzania.

2. PRESENTATION OF CASE

On the 12th June 2023 an yearling male calf was found dead in the morning in one of the dairy cattle farms in Mbeya city, Tanzania. According to the animal attendant, before death the animal was recumbent with decreased appetite for seven consecutive days, and was treated using oxytetracycline and multivitamin. Unfortunately, the prognosis was poor, thus the animal died. The owner requested for a necropsy service in order to establish the cause of death of the animal. Necropsy was carried out by using standard procedures described previously [11]. Gross pathological findings included a cooked-like shrunken liver with flabby consistence and large necrotic foci (Figure 1). Dark blue discoloration of the kidneys was also evident. The discoloration involved the entire organs, and both kidneys were equally affected to the same extent (Figures 2 and 3). However, the kidneys had normal gross morphology i.e. normal size and texture (consistence). Based on the history and gross pathological findings, the animal was diagnosed to have died of acute hepatitis.

Differential diagnosis for the kidneys discoloration included hemochromatosis [12], renal hemosiderosis, renal lipofuscinosis, and melanotic renal cell carcinoma (MRCC) [13]. Renal hemosiderosis is a disease in which hemosiderin deposits in the renal cortex as a form of iron overload. It is a complication of chronic intravascular hemolytic states such as hemolytic anemia, paroxysmal nocturnal hemoglobinuria and mechanical hemolysis from prosthetic cardiac valve [14]. Hemochromatosis is a disease characterized by an accumulation of iron in the liver and other organs including the kidneys [15] leading to injury to tissues, particularly the liver [16]. A carcinoma is a type of cancer that forms solid tumors. Like other types of cancer, carcinomas are abnormal cells that divide without control. Carcinomas form in epithelial cells, which line the outer surface of the skin and the covering and lining of organs and internal passageways, such as the gastrointestinal tract [17].

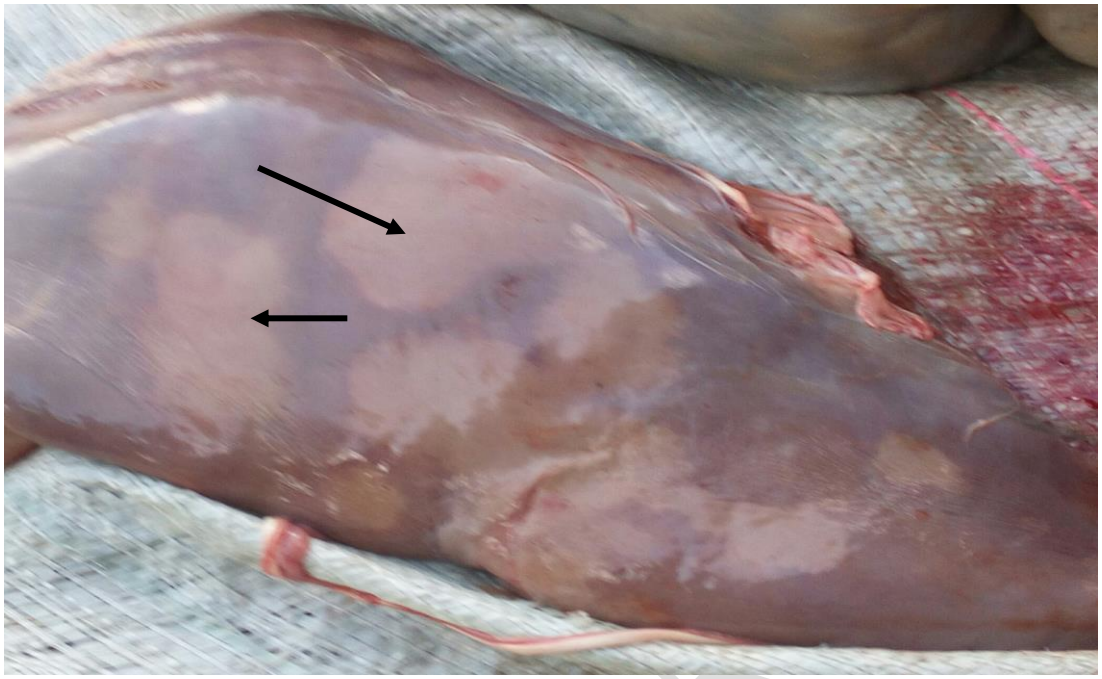

Fig. 1. An image of a cooked-like shrunken liver showing large pale necrotic foci (arrows).

Fig. 2. An image of a right kidney showing dark blue discoloration of the renal surface.

Fig. 3. An image of a left kidney showing dark blue discoloration of the renal surface.

Based on gross pathology, the disorder was diagnosed to be renal lipofuscinosis (black kidneys). The diagnosis was made after ruling out renal hemosiderosis, hemochromatosis and MRCC in the list of possible causes of the kidneys discoloration based on the absence of gross pathological findings which are characteristic for each of these diseases. Renal hemosiderosis was ruled out because the dead animal was not anemic; this was indicated by lack of pallor. Anemia is a consistent characteristic feature of hemosiderosis [14, 18, 19, 20, 21, 22]. Hemochromatosis was excluded because of lack of hepatic fibrosis, a gross pathological finding involving the liver which has been consistently reported in hemochromatosis cases [12, 15, 23, 24, 25, 26, 27]. MRCC was ruled out because grossly the kidneys were free of tumor tissue, which is a characteristic feature of renal cell carcinoma [28, 29, 30, 31, 32] and other types of cancer. Because of budget limitations, histopathology could not be conducted to confirm the diagnosis.

3. DISCUSSION

Generally, BRL is a rare disorder in cattle which has been reported to be incidentally encountered during meat inspection after slaughter of cattle found to be clinically healthy during ante-mortem inspection [1, 2, 3, 4]. Unlike the previous reports, this paper reports a case of BRL encountered at necropsy which revealed a cooked-like shrunken liver with flabby consistence and large pale necrotic foci, and dark blue discoloration of both kidneys.

Although in addition to a cooked-like shrunken liver with flabby consistence and large pale necrotic foci, dark blue discoloration of the kidneys was also evident at necropsy, pathological changes found in the liver were found to be more significant. Therefore, based on history and gross pathology the animal was diagnosed to have died of acute hepatitis. The animal's death could be attributed to acute hepatic failure which is one of the sequelae of acute hepatitis [33, 34, 35, 36, 37]. The kidneys discoloration was not considered as an attributing factor to the animal's death because with exception of the discoloration, the kidneys had no pathological changes (had normal gross morphology). In addition to that, to date there is no report of a clinical disease in cattle which is associated with BRL.

In this necropsy both kidneys were found to have dark blue discoloration and were equally discolored to the same extent. These findings are consistent with similar findings reported previously [4]. Normal gross morphology of the discolored kidneys reported here is in agreement with similar incidental findings by Rude et al. [3] at meat inspection where cattle kidneys with dark brown to black discoloration due to deposition of lipofuscin pigment were found to have normal gross morphology. Moreover, the finding is congruous with a previous incidental finding by Lund and Olsen [38] at surgery of a human patient where the kidneys with diffuse dark brown discolouration due to deposition of lipofuscin pigment in the epithelium of the proximal tubules were found to have normal gross morphology. These findings suggest that renal lipofuscinosis does not seem to have had any harmful effect on the kidneys morphology and functions.

BRL is a rare disorder in cattle which has been reported in Holland, Germany, Sweden, Norway [4], and Denmark [3, 4]. Tanzania has been importing heifers, bulls and semen from Europe and the United States for breeding purpose [39, 40, 41]. Having a genetic etiology, this BRL case could be associated with importation of the animals and semen from BRL-affected countries. To the best of my knowledge, this is the first report of BRL in Tanzania and the African continent at large.

4. CONCLUSION

Based on gross pathological findings, it is concluded that a case of BRL reported here was an incidental finding at necropsy. The finding is not associated with the animal's death.

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