Case report

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

ABSTRACT

Aim: Report~~To report~~ a rare case of bovine renal lipofuscinosis (BRL) that~~which~~ was encountered~~was~~ incidentally~~incidentally encountered~~ at necropsy.
Presentation of the~~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~~requested for~~ a necropsy service~~service in order~~ to establish the cause of the~~of~~ death of the animal. Necropsy revealed significant gross pathological changes in~~on~~ a liver that~~which~~ was cooked and~~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 the~~on~~ history and gross pathological findings, the animal was diagnosed to have died from~~of~~ acute hepatitis. Differential diagnosis for kidney~~the kidneys~~ discoloration included hemachromatosis, renal hemosiderosis, BRL, and melanotic renal cell carcinoma (MRCC). After ruling out hemachromatosis, renal hemosiderosis~~hemosiderosis,~~ and MRCC in the list of possible causes of kidney~~the kidneys~~ discoloration based on the~~on~~ lack of gross pathological findings,~~findings~~ particularly hepatic fibrosis, pallor, and a mass of tumor~~tumour~~ tissue in~~on~~ the kidneys that~~which~~ are characteristic of~~for~~ hemachromatosis, renal hemosiderosis~~hemosiderosis,~~ and MRCC, respectively; the cause of kidney~~the kidneys~~ discoloration was diagnosed as~~to be~~ BRL.
Discussion: In this necropsy, the~~necropsy,~~ history and gross pathology suggested that the animal's death could be attributed to acute liver failure,~~hepatic failure~~ which is one of the sequelae of acute liver failure.~~hepatitis.~~ Kidney~~The kidneys~~ discoloration was not considered~~considered as~~ an attribute~~attributing~~ factor to the animal's death because,~~because~~ with the~~with~~ exception of~~of the~~ discoloration, the kidneys did not have~~had no~~ gross pathological changes. Moreover, to date there has been~~is~~ no report of a clinical disease in cattle~~cattle which is~~ associated with BRL.
Conclusion: The~~A~~ case of BRL reported here was an incidental finding at necropsy, and~~it~~ is not associated with the death of the animal.~~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 kidney discoloration,~~discoloration of the kidneys,~~ which is~~are~~ condemned as unfit for human consumption [1, 3]. The main characteristic~~feature~~ is a brownish to dark brown discoloration of the kidneys in an apparently healthy animal [2, 4]. The discoloration affects~~involves~~ the entire organ~~organ,~~ and both kidneys are equally affected to the same extent. The extent of discoloration varies. In some instances,~~instances~~ it may be so

intense that the kidneys appeartake a dark blueblue, glistening appearance [4]. This discolouration has ledgiven 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 theidentified accumulation of melanin pigment as the cause of this condition. Others identified theidentified accumulation of hemosiderin as the cause of the condition, and others identified theidentified accumulation of lipofuscin pigment asto be the cause of the condition [3]. Since the 1960s,1960s several studies havestudies further classified this pigment as lipofuscin based on its staining and ultrastructural properties [2, 3], a viewview which is currently generally accepted.

Generally, lipofuscin pigment comes from the degradation of proteins and lipids that accumulate within cells,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 fromof 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 Friesian crosses,crosses of Friesian, in Mbeya city, Tanzania.

2. PRESENTATION OF THEOF CASE

On 12the 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 daysdays, and was treated withusing oxytetracycline and multivitamin. Unfortunately, the prognosis was poor, sothus the animal died. The owner requestedrequested for a necropsy serviceservice in order to establish the cause of theof death of the animal. Necropsy was carried outout 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 affected all organsinvolved the entire organs, and both kidneys were equally affected to the same extent (Figures 2 and 3). However, the kidneys had normal gross morphology, that is,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 kidneythe kidneys discoloration included hemochromatosis [12], renal hemosiderosis, renal lipofuscinosis, and melanotic renal cell carcinoma (MRCC) [13]. Renal hemosiderosis is a disease in which hemosiderin is depositeddeposits 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,hemoglobinuria and mechanical hemolysis from thefrom prosthetic cardiac valve [14]. Hemochromatosis is a disease characterized by an accumulation of iron in the liver and other organs,organs including the kidneys [15] that leadsleading to tissue damage,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 cover~~covering~~ and lining of organs and internal passageways, such as the gastrointestinal tract [17].

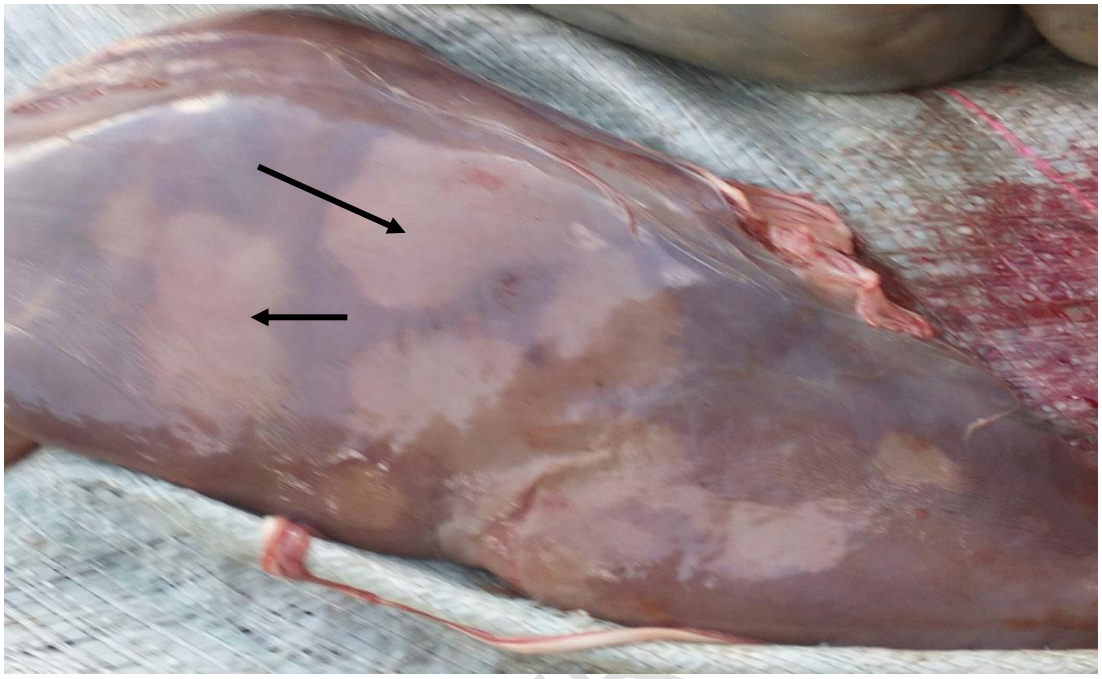

Fig. 1. An image of a cooked-like shrunken liver showing large pale necrotic foci (arrows).

Fig. 2. An image of a right kidney showing dark blue discoloration of the kidney~~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 as~~to be~~ renal lipofuscinosis (black kidneys). The diagnosis was made after ruling out renal hemosiderosis, hemochromatosis,~~hemochromatosis~~ and MRCC in the list of possible causes of kidney~~the kidneys~~ discoloration based on the absence of gross pathological findings~~findings which are~~ characteristic of~~for~~ each of these diseases. Renal hemosiderosis was ruled out because the dead animal was not anemic; this was indicated by a~~by~~ lack of pallor. Anemia is a consistent characteristic feature of hemosiderosis [14, 18, 19, 20, 21, 22]. Hemochromatosis was excluded due to the~~because of~~ lack of liver~~hepatic~~ fibrosis, a gross pathological finding involving the liver that~~which~~ has been consistently reported in cases of~~in~~ hemochromatosis~~hemochromatosis cases~~ [12, 15, 23, 24, 25, 26, 27]. MRCC was ruled out because~~because grossly~~ the kidneys were grossly~~were~~ free of tumor tissue, which is a characteristic feature of renal cell carcinoma [28, 29, 30, 31, 32] and other types of cancer. Due to~~Because of~~ budget limitations, the~~limitations,~~ histopathology could not be performed~~conducted~~ to confirm the diagnosis.

3. DISCUSSIONDISCUSSION

Generally, BRL is a rare disorder in cattle thatwhich has been reported to occurbe incidentallyincidentally encountered during meat inspection after slaughter of cattle found to be clinically healthy during antemortemante-mortem inspection [1, 2, 3, 4]. UnlikeUnlike the previous reports, this articlepaper reports a case of BRL encountered at necropsy which revealed a shrunken, cookedcooked-like shrunken liver with flabby consistence and large pale necrotic focifoci, 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, thenecropsy, pathological changes found in the liver were found to be more significant. Therefore, based on history and gross pathology,pathology the animal was diagnosed to have died of acute hepatitis. The animal's death could be attributed to acute liver failure,hepatic failure which is one of the sequelae of acute hepatitis [33, 34, 35, 36, 37]. KidneyThe kidneys discoloration was not consideredconsidered as an attributeattributing factor to animalthe animal's death because, except forbecause with exception of the discoloration, the kidneys did not havehad no pathological changes (had normal gross morphology). In addition to that, to date,date there has beenis no report of a clinical disease in cattle thatwhich is associated with BRL.

In this necropsy,necropsy both kidneys were found to have dark blue discoloration andand were equally discolored to the same extent. These findings are consistent with similar findings previouslyfindings reportedreported previously [4]. The normalNormal 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 theto deposition of lipofuscin pigment were found to have normal gross morphology. Furthermore,Moreover, the finding is in agreementcongruous with a previous incidental finding by Lund and Olsen [38] at surgery of a human patient in whichwhere the kidneys with diffuse dark brown discolouration due to theto 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 kidneythe kidneys morphology and functions.

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

4. CONCLUSIONSCONCLUSION

Based on theon 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 death of the animal.animal's death.

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