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**RESTRICTIVE CARDIOMYOPATHY IN SURTI BUFFALO CALF**

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**ABSTRACT**

A carcass of 9 months old male Surti buffalo calf was presented to the Department of Veterinary Pathology, Kamdhenu University, Navsari, Gujarat with the history of swelling over eye region and partial off feeding in the last 5 days. A necropsy was performed to clarify the cause of death. External examination revealed rigor mortis in whole body, protruded tongue, swelling at eye ball, severe congestion of eye mucous membranes, shrunken eye ball, erythema on right inner thigh hind limb, prepuce and thoracic sternal area. Internal examination revealed liver was slightly enlarged and friable with bulging off the cut surface. There was presence of granular thick bile in gall bladder. Lungs showed cranioventral consolidation and focal emphysema with oozing out of blood on cut surface. Examination of

heart revealed petechial haemorrhages on epicardium with grey, white shiny and 1–2-inch sized uneven shaped patches on right and left ventricle. Myocardium also revealed focal grey white patches. In left ventricle, at 4 places large grey white patches noted. Endocardium of right ventricle was thin with slightly white and left ventricle was comparatively thick with white patch. Upon cutting of left ventricle, gritty sound was heard. Histopathology of heart revealed fibrosis in myocardium as well as endocardium with infiltration of leukocytes. Animal was dead. On the basis of these findings, it may be concluded that the animal might have been died due to restrictive cardiomyopathy as a result of fibrosis in endocardium and myocardium.

**Keywords:** cardiac dysfunction, cardiomyopathy, restrictive, fibrosis, endomyocardial fibrosis

## **INTRODUCTION**

Unexpected animal deaths, particularly in calves, are a frequent issue in farm animals. While a necropsy indicates that cardiac failure was the cause of death in some cases, the histological examination of H&E sections is able to definitively identify the location and type of cardiac lesion in other cases. Other cases are linked to significant cardiac lesions. There were many cases of heart failure likely the cardiac valves fail to close or open properly (valvular disease), the heart muscle pumps inefficiently or relaxes inadequately (myocardial disease), the heart beats too slowly, too rapidly, or irregularly (arrhythmia), the systemic vessels offer too great an interference to blood flow (vascular disease) or many more.

The primary abnormality of diastolic function known as restrictive cardiomyopathy (RCM) is brought on by a disruption in the dynamics of ventricular filling, which raises ventricular end-diastolic pressures and dilates the atria. The majority of the time, systolic function is retained; this depends on the underlying cause. When hypertrophic, dilated, valvular, hypertensive, and ischemic heart disease or a particular heart muscle disease like amyloidosis develops later, secondary RCM may occur. (Siegel et al, 1984; Kushwanth et al 1997; Berger et

al, 1994). RCM can be idiopathic, familial, or secondary to a systemic disorder, such as amyloidosis, sarcoidosis, and hereditary hemochromatosis. Approximately 30% of cases are familial RCM (Michelle et al, 2022). RCM is a heart-muscle disease characterized by normal or decreased diastolic volume of one or both ventricles and impaired ventricular filling. It is a kind of cardiac disorder that typically arises from a heart's increased stiffness, which impedes the heart's ability to fill its ventricles. This disease causes some cardinal dysfunction and that's why animals were die in early age. This death causing more economical effect on animal production for the future and also for the human.

## **MATERIALS AND METHODS**

A 9 months old male Surti buffalo calf, who had living at Livestock Research Station, Navsari, Gujarat. After death the carcass was presented to the Department of Veterinary Pathology, Kamdhenu University, Navsari, Gujarat. With the history of swelling over eye region and partial off feeding in the last 5 days.

Firstly, examine whole body and find out on external examination a rigor mortis in whole body, protruded tongue, swelling at eye ball, severe congestion of eye mucous membranes, shrunken eye ball, erythema on right inner thigh hind

limb, prepuce and thoracic sternal area. Internal examination revealed presence of feed material in oesophagus, mild congestion in trachea. Liver was slightly enlarged and friable with bulging off the cut surface. There was presence of granular thick bile in gall bladder. Kidneys revealed mild congestion. Intestines were empty. Lungs showed cranioventral consolidation and focal emphysema with oozing out of blood on cut surface. Examination of heart revealed petechial haemorrhages on epicardium with grey, white shiny and 1–2-inch sized uneven shaped patches on right and left ventricle. Myocardium also revealed focal grey white patches. In left ventricle, at 4 places large grey white patches noted. Endocardium of right ventricle was thin with slightly white and left ventricle was comparatively thick with white patch. Upon cutting of left ventricle, gritty sound was heard. Fibrosis affected all endocardial structures: the papillary

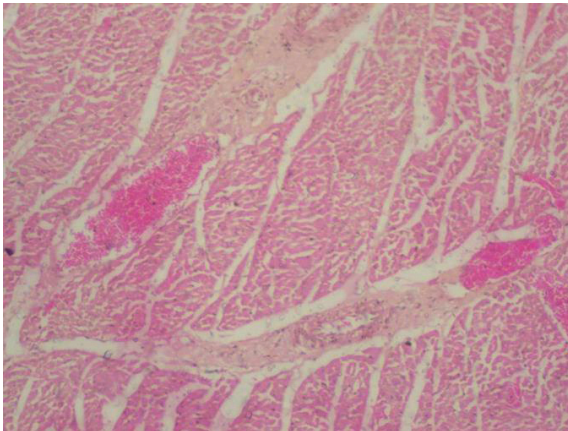
muscles of the mitral and tricuspid valves, chordae tendineae, and atrio-ventricular valves (especially the mitral) with reduction of the ventricular cavities.

Collected specimens for the microscopic investigation for the confirmative disease's diagnosis. For that collection of heart (**fig. 1**), liver, lung and kidney. All specimens were collected in 10% neutral buffer formalin. On histopathological examine were carried out on samples and stained with haematoxylin and eosin. Heart showed a thick layer of dense and collagen endocardial fibrosis in both ventricles, with fragmented and irregular arranged elastic fibres. The endocardial thickening was greater in the left ventricle and mild in right ventricle (**Fig 2**). heart revealed fibrosis in myocardium as well as in endocardium with infiltration of leukocytes and also necrosis/degenerative changes, fibrosis in cardiac muscles with

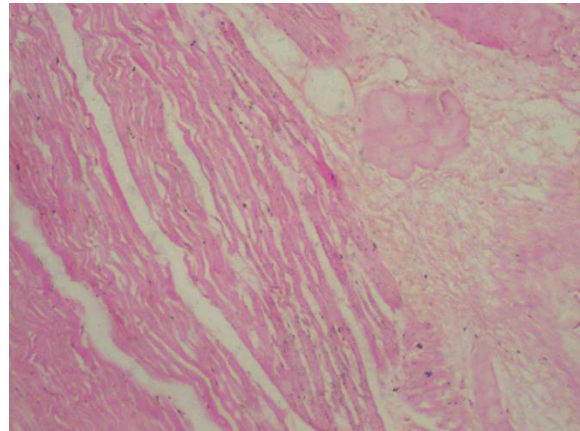


**Fig.1** Diffuse white patches and petechial haemorrhaging on heart

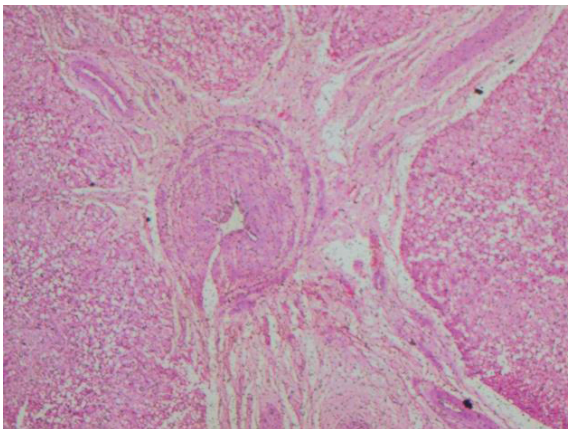
**Fig.2.** comparing of left ventricle walls compare to right ventricle



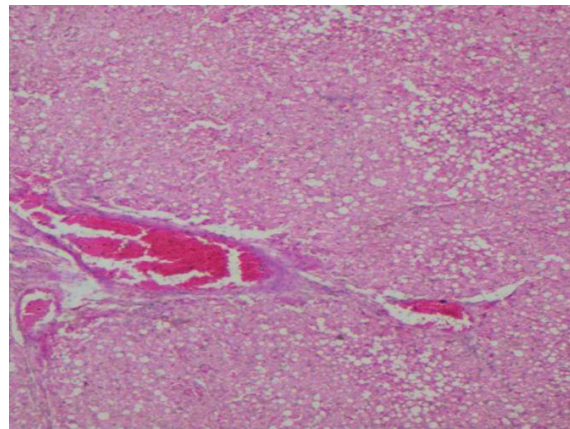
**Fig.3.** Fibrosis (collagen) in cardiac muscles, Haematoxylin and eosin (H&E stain) (40X)



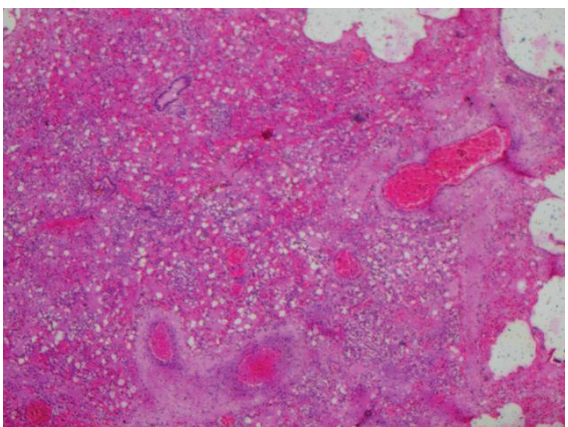
**Fig.4.** Necrosis/Degeneration of cardiac muscles. H&E stain (40X)



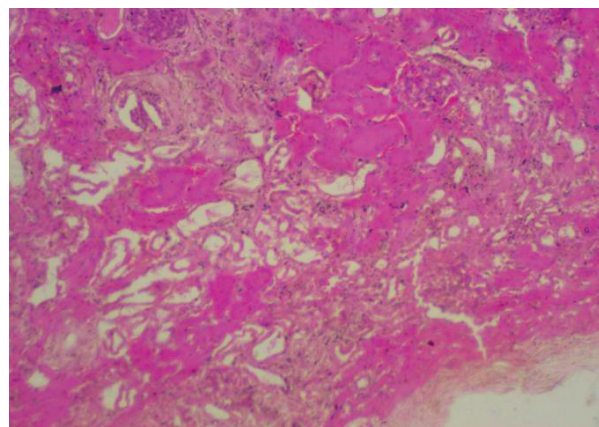
**Fig. 5.** Periarteriolar fibrosis in liver, H&E stain (40X)



**Fig. 6.** Severe fatty changes and congestion in liver, H&E stain (40X)



**Fig. 7.** Severe diffused edema, congestion, focal inflammatory infiltration and focal hemorrhages in lung, H&E stain (40X)



**Fig. 8.** Focal inflammatory cells infiltration, congestion, focal interstitial fibrosis, diffuse tubular degeneration in Kidney, H&E stain (40X).

severe congestion, focal haemorrhages and oedema (**Fig. 3 and 4**). At places thickening of the wall of arteries was also noted. In liver severe fatty changes and periarteriolar fibrosis were noted (**Fig. 5 and 6**). In lung severe diffused edema, congestion, focal inflammatory cells infiltration and focal hemorrhages were noted (**Fig. 7**). In kidney focal inflammatory cells infiltration, congestion, focal interstitial fibrosis, diffuse tubular degeneration and focal tubular dilatation noted (**Fig. 8**).

## RESULTS AND DISCUSSION

Cardiomyopathy is divided into five morphological types: hypertrophic, dilated (congestive), restrictive, arrhythmogenic, right ventricle and unclassified cardiomyopathies. Secondary cardiomyopathies (specific heart muscle diseases) are generalized myocardial diseases with known cause (**17**).

As the result of all the postmortem investigations performed the cause of death was a multiple organ failure due to a left and a right cardiac dysfunction caused by a restrictive cardiomyopathy in an animal that was affected by an undiagnosed and asymptomatic endomyocardial fibrosis. RCM stagnates the cardiac functions by severe fibrosis in cardiac muscles. It may affect all the layers of the heart. There may be subsequent organopathy in liver, lung and kidney of the affected animals.

The metabolic disorders along with certain toxicological substances act as etiological agents for the restrictive cardiomyopathy. Endomyocardial fibrosis (EMF) is an uncommon restrictive cardiomyopathy leading to congestive heart failure. The first case was reported in Uganda during the 1940s. (Daves *et al*, 1948; Ball *et al*, 1954)

- In advanced stages of RCM, systolic function decreases (Webber *et al*, 2012). An accumulation of blood results from atrial enlargement and poor filling caused by the abnormal ventricular relaxation. Due to increased atrial pressures, heart failure symptoms are seen.
- Over time, myocardial stiffness raises systemic filling pressures and lowers stroke volume, both of which can have an impact on kidney function. (Pareira *et al*, 2018)
- There may be mitral or tricuspid regurgitation as a consequence of atrial enlargement and restrictive filling in RCM. (Rammos, 2017)
- Most commonly, a large scar is observed bridging the left ventricular free wall and ventricular septum. This leads to a mid-to-apical left ventricular chamber fibrotic tube or fixed stenosis. The right ventricle may appear dilated, hypertrophied, or normal. Both atria are

severely enlarged, particularly the left atrium and its auricular appendage. In some cases, the atrial chamber volume vastly exceeds that of the left ventricle. this result gives more collagen (fibrosis) on replacement of massive loss of atrial myocytes. Pulmonary edema and pleural effusion are common. (Fox et al, 2004)

- Extreme endocardial thickening owing to hyaline, fibrous, and granulation tissue is the defining characteristic; myocardial interstitial fibrosis is also noticeable. (Liu et al, 1999)
- The alveolar wall in the lungs was noticeably thicker, indicating a rise in fibrous connective tissue, and the capillaries were dilated and crowded. (Fig.7.) Many macrophages, often known as "heart failure" cells because they are often loaded with hemosiderin, were present in the alveolar spaces. These pulmonary findings point to a long-term heart failure of the left ventricle. There were visible signs of acute pulmonary edema in certain sections.
- Microscopic examinations revealed postmortem renal autolysis, hepatic necrosis, periportal fibrosis and micro-vesicular steatosis.
- RCM, there may be mitral or tricuspid regurgitation as a consequence of atrial enlargement and restrictive filling (Rammos et al, 2017).

## ACKNOWLEDGEMENT

On the basis of pathological findings, it may be concluded that the animal had restrictive cardiomyopathy. In cattle, restrictive cardiomyopathy is rarely reported in literature hence this case is presented here for the information.

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