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## Echocardiographic changes in indices of buffaloes affected with peritonitis in relation to normal buffaloes

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### Abstract

The objective of this study was to compare and evaluate echocardiographic findings in Murrah buffaloes suffering from peritonitis in comparison to normal buffaloes. Normal buffaloes (n = 15) and affected with peritonitis (n = 10) diagnosed clinically, ultrasonographically for peritonitis. Fifteen healthy buffaloes were included in this study as controls. End systolic volume (EDV) (ml) and stroke volume (SV) (ml) were decreased significantly and there were non significant changes found in other echocardiographic parameters. No structural and functional changes of heart were found in the cases suffering from peritonitis buffaloes.

**Keywords:** buffaloes, heart, echocardiography, peritonitis

### 1. Introduction

Peritonitis is an inflammation of the serous membrane of the peritoneal cavity. It may be a primary disease or secondary to other pathologic conditions. Different infectious and noninfectious agents may cause peritonitis, which may result in a variety of clinical manifestation, disease progression, and outcome. Peritonitis may be acute or chronic, septic or nonseptic, local or diffuse, or adhesive or exudative. Clinical signs of peritonitis in bovine are often nonspecific and characterized by reduced feed intake, drop in milk production, and decreased rumination activity. Prognosis strongly depends on the character and severity of the disease and therefore, must be determined individually, General survival rates of 50% - 70% have been reported, with much lower rates for return of productivity in farm animals [1]. Surgical disorders of gastrointestinal tract occur frequently in bovine, and veterinarians are challenged to determine an accurate diagnosis and treatment for these condition. Surgical diseases in bovines are encountered in the forestomach (dislocated abomasums, reticuloperitonitis), colon (caecal dilatation) and small intestines (duodenum, jejunum, ileum) [2]. The physiology of the body is affected by the amount of blood pumped by the heart to the different tissue [3, 4] reported that smaller cardiac output was observed in lactating goats with low milk production. Milk production is directly related to the blood flow in the mammary glands [5, 6].

Real-time two-dimensional echocardiography has been used to visualize cardiac structures and their motions and has been highly appraised [7-9]. M-mode study can be performed to take different cardiac measurements associated with diaphragmatic hernia in parasternal long axis and the short axis. Echocardiographic images are also used to acquire quantitative information about cardiac function. Mathematical formulas are then applied to determine values for cardiac output, ejection fraction, ventricular wall stiffness, and other cardiac functions. The measurements obtained from the parasternal long axis and short axis m-mode can also be used to assess the left ventricular systolic function [10]. The perusal of the available literature revealed that very limited work has been done. Studying the changes if any in the echocardiographic indices in buffaloes having peritonitis as compared to the normal buffaloes. This study was, therefore, designed to compare the echocardiographic indices in buffaloes suffering from peritonitis in relation to normal animals.

### 2. Materials and Methods

#### 2.1. History and clinical examinations

Twenty five murrah buffaloes (*Bubalus bubalis*) were examined in the Department of Surgery and Radiology, College of Veterinary Science, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India.

The buffaloes (n=15) presented to the hospital for superficial injury like teat abrasion, skin trauma were considered as control group for echocardiographic evaluation. Ten buffaloes diagnosed clinically and ultrasonographically for peritonitis formed the other group. Diseased buffaloes were referred to the hospital because of anorexia, sharp drop in milk yield, high rise of temperature. The duration of illness varied from 1 to 2 weeks before admission. There was a history of previous medications including antibiotic injections, fluid therapy. All animals were examined clinically as described before which included general condition and auscultation of the heart, lungs, and rumen. In addition, rectal temperature, respiration rate and heart rates were also recorded. The general health condition of most of the animals was deteriorated.

**2.2 Haematology**

Two ml of blood was drawn by venipuncture of the jugular vein using 18 gauge hypodermic needle and transferred to the sterile vial containing ethylene Diamine Triacetate (EDTA). From the pooled blood, routine haematology was performed which included red blood cells (RBCs), Haemoglobin (Hb), Total leukocyte count (TLC), Differential leukocyte count (DLC) and Packed cell volume (PCV).

**2.3 Statistical analysis**

Descriptive statistical analysis was performed using SAS 9.4 (SAS institute USA). Student t-test; two sample assuming unequal variance was used to determine the significant difference between two groups. The objective data was calculated for mean ± SE wherever applicable, The level of significance was statistically considered at 5%. The resultant data was presented as mean ± SE for each parameter.

**2.4 Echocardiographic examination**

The echocardiography was performed between the 3<sup>rd</sup> to 5<sup>th</sup> intercostal spaces on both the sides of the thorax after application of ultrasound gel over the shaved area. Echocardiography was conducted on standing animal by using GE Healthcare F 8 ultrasound machine equipped with cardiac probe of frequency ranging from 2.8 to 3.6 MHz. None of the animal was sedated or tranquilized. The left parasternal long axis view was obtained at 4<sup>th</sup> intercostal space, 9-11 cm above the olecranon, transducer was directed cranio-dorsally with a rotation of 0-40°. The structures visible were left ventricle, left ventricular outflow tract, aortic valve, aorta, right atrium and right ventricle. Once the structures such as left ventricle, left ventricular outflow tract, right ventricle were visible, the M-mode cursor was placed at the level of chordae and M-mode images were obtained. The M-mode images for study of left atrial diameter were taken by placing the M-mode cursor to the level of aorta and left atrium. The M-mode measurement of the right ventricular internal diameter at diastole (RVIDd), interventricular septum thickness at end diastole (IVSd) and end systole (IVSs), left ventricular internal diameter at end diastole (LVIDd) and end systole (LVIDs), left ventricular posterior wall thickness at

end diastole (LVPWd) and end systole (LVPWs) were obtained.

**2.5 Diagnosis**

Based on the clinical examinations, including diseased buffaloes were classified into 2 groups: group 1 with normal buffalo (n=15) and group 2 with peritonitis (n=10). The clinical signs of dullness, depression, anorexic, high rise of temperature, sudden drop in milk production were characteristic features. With the help of B mode ultrasonography fluid columns (fibrinous, exudative) were observed in different parts of the body (generally in ventral abdomen and caudal abdomen region), suggestive of peritonitis.



Fig 1: ultrasonogram showing fibrinous peritonitis (fluid column)



Fig 2: ultrasonogram showing M-mode echocardiography in buffalo affected with peritonitis

**3. Results**

**3.1 Clinical presentation and clinical findings**

Clinical findings of all buffaloes were recorded. Buffaloes affected with peritonitis showed sign of dullness, anorexia, respiratory distress, high rise of temperature and sudden drop in milk yield.

**Tables 1:** Table depicting clinical parameters in normal buffalo and those affected with peritonitis

Parameters	Normal (n=15)	Peritonitis (n=10)
Age (years)	7.53±0.48 (5.00-12.00)	8.95±0.88 (5.50-15.00)
Body weight (kg)	378.46±10.02 (300.00-450.00)	368.23±10.01 (300.00-410.50)
Respiration rate (per minute)	36.13±1.57 (27.00-46.00)	30.50±2.59 (21.00-46.00)
Heart rate (beats/min)	57.70±0.32 (54.41-59.76)	65.16±1.95** (56.21-73.43)
Rectal temperature (°F)	100.47±0.11 (100.00-101.40)	101.67±0.33** (100.00-103.50)

NS p≥ 0.05, \*p<0.05, \*\*p<0.01

**Table 2:** Table depicting haematological parameter of normal buffalo and those affected with peritonitis.

Parameters	Normal (n=15)	Peritonitis (n= 10)
Haemoglobin (g/dl)	12.02±0.33 (10.00-14.00)	9.09±0.25 (7.80-10.20)
Red blood Cells(x 10 <sup>6</sup> )	5.84±0.17 (5.00-6.90)	6.16±0.13 (5.45-6.71)
Packed cell volume (%)	35.64±0.74 (30.15-39.06)	23.48±0.43 (21.45-25.67)
Total leucocyte count (x10 <sup>3</sup> )	10.25±0.20 (8.99-11.70)	10.33±0.91** (6.45-14.34)
Neutrophills(%)	56.31±0.47 (54.11-59.88)	64.30±1.16** (58.00-68.56)
Lymphocytes(%)	39.31±0.07 (38.92-39.83)	32.07±0.40** (30.00-33.71)
Monocytes (%)	2.33±0.06 (1.87-2.67)	2.10±0.05 (1.89-2.43)

NS p<sub>≥</sub> 0.05,\*p<0.05,\*\*p<0.01

**Table 3:** Comparison of cardiac parameters between normal buffaloes and those affected with peritonitis.

Parameters	Normal(n=15)	Peritonitis(n=10)	t-value	P
LVIDd (cm)	7.91±0.05 (7.21-8.16)	7.84±0.08 (7.23-8.22)	0.70	0.39
LVIDs (cm)	5.28±0.08 (5.04-6.51)	5.28±0.04 (5.09-5.45)	-0.01	0.06
FS%	33.26±1.06 (20.22-36.92)	32.61±1.04 (24.62-36.86)	0.41	0.51
EDV (ml)	336.67±4.79 (273.01-360.17)	330.68±7.57 (274.72-366.09)	0.70	0.37
ESV(ml)	134.97±5.93 (120.45-216.75)	134.38±2.32** (123.25-144.35)	0.08	0.002**
EF %	59.88±1.60 (39.82-64.95)	61.65±1.12 (58.88-71.23)	-0.81	0.09
SV (ml)	201.69±6.26 (143.42-223.20)	201.39±2.26** (190.23-218.32)	-0.09	0.0009**
CO (lit/min)	12.46±0.28 (11.04-15.74)	11.78±0.58 (9.60-15.74)	1.16	0.07
CI (lit/m <sup>2</sup> )	9.16±0.12 (8.55-10.12)	8.75±0.09 (8.34-9.45)	2.39	0.13
IVSd (cm)	1.95±0.03 (1.54-2.07)	1.95±0.04 (1.54-2.11)	0.07	0.46
IVSs (cm)	2.69±0.04 (2.21-2.95)	2.39±0.08 (2.12-2.83)	3.29	0.16
LVPWd (cm)	1.65±0.03 (1.43-1.98)	1.66±0.06 (1.34-1.99)	-0.20	0.11
LVPWs (cm)	2.71±0.05 (2.32-3.20)	2.39±0.06 (2.11-2.80)	3.83	0.83
RVIDd (cm)	2.47±0.04 (2.20-2.76)	2.31±0.08 (1.94-2.67)	1.74	0.09
EPSS (cm)	0.72±0.01 (0.62-0.74)	0.70±0.02 (0.66-0.73)	0.46	0.67

NS p<sub>≥</sub> 0.05,\*p<0.05,\*\*p<0.01

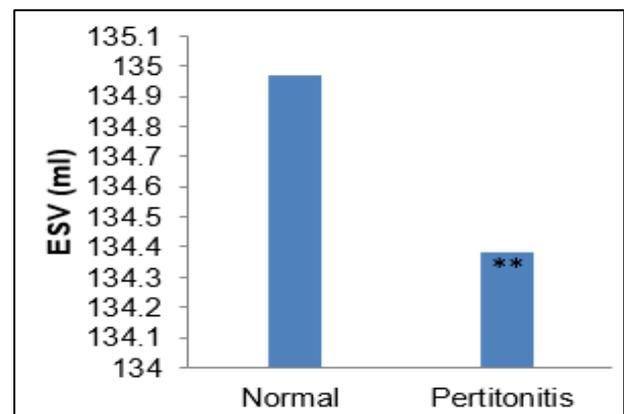
#### 4. Discussion

In case of peritonitis rectal temperature was significantly increased, respiration rate was decreased non significantly, although was but within in normal range and heart rate was significantly increased from the normal (Table.1). It could be because of high temperature and inflammation [11]. reported the mean rectal temperature, heart rate and respiration rate as 102.6±0.22°F, 78±2.90 bpm and 14.40±0.50/ min, respectively in buffaloes affected with TRP [12]. reported mean rectal temperature, respiration rate and heart rate as 101.3±0.7°F, 48.5±4.5/min and 89±6.3 bpm in Egyptian cattle suffering from traumatic reticulo-peritonitis [13]. reported the mean rectal temperature, heart rate and respiration rate as 103.8±0.03 °F, 78.24±2.3 bpm and 32.21±0.62/min in cattle suffering from traumatic reticulo-peritonitis.

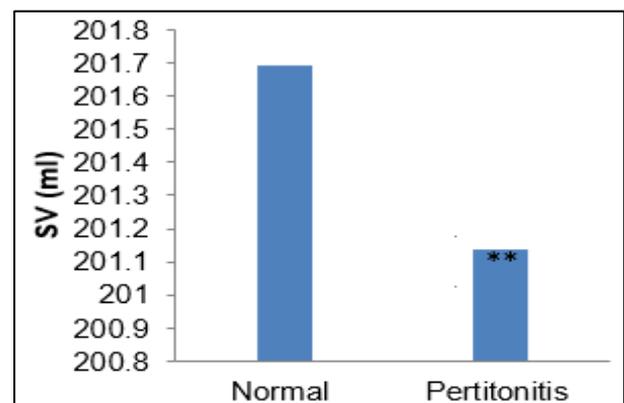
Inbuffaloes having peritonitis, the mean±SE of hemoglobin (g/dl) and monocyte count (%) decreased non significantly whereas lymphocyte (%) and packed cell volume (%) decreased significantly. Total leukocyte count (x10<sup>3</sup>) and neutrophils (%) were increased significantly whereas Red blood cells 9x10<sup>6</sup>) increased non significantly. (Table.2) Leukocytosis with left- shift and neutrophilia are common haematological finding with traumatic reticuloperitonitis [14].

The buffaloes suffering from peritonitis had non significantly decreased values of left ventricular internal diameter at diastole (LVIDd) (cm), end systolic volume (ESV) (ml), inner ventricular septum thickness at diastole (IVSs) (cm), left ventricular posterior wall thickness at diastole and systole (LVPWd and LVPWs) (cm), fractional shortening (FS) (%), Cardiac output (CO) (lit/min) and cardiac index (CI) (lit/m<sup>2</sup>), whereas ejection fraction (EF) (%) were increased non significantly when compared with the value of normal buffaloes. End systolic volume (EDV) (ml) and stroke volume (SV) (ml) were decreased significantly and there as no change observed in left ventricular internal diameter at systole

(LVIDs) (cm) and inter ventricular septum thickness at diastole (IVSd) (cm). (Table.3)



**Fig 3:** Bar graph showing ESV (ml) (mean±SE) of normal buffaloes and those affected with DH



**Fig 4:** Bar graph showing SV (ml) (mean±SE) of normal buffaloes and those affected with DH

Changes in echocardiographic parameters were observed in diseases which compress the heart (e.g. pericarditis, pleural effusion, diaphragmatic hernia and cystic diseases) whereas the conditions which do not directly compress the heart (peritonitis, reticular abscess) showed no changes on echocardiography<sup>[15]</sup>.

In buffaloes with traumatic reticulo-peritonitis echocardiography can be used to identify morphological changes in the region of the cranial, ventral or caudal reticular wall<sup>[16]</sup>. The study concluded that there was no structural and functional changes of heart was found in the cases suffering from peritonitis in buffaloes.

## 5. Acknowledgments

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## 6. Abbreviations

LV, left ventricle; RV, right ventricle; LA, left atrium; RA, right atrium.

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