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## Comparative evaluation of radiography and ultrasonography in canine abdominal disorders

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### Abstract

Eighteen clinical cases of dogs of either sex presented to TVCC, Veterinary College and Bidar were subjected to systemic evaluation for diagnosis of the abdominal disease condition, including determination of haemato-biochemical parameters and diagnostic imaging. With the help of this modulates abdominal affections were diagnosed as intussusception, pyometra, cystitis and prostate hyperplasia. In intussusception, plain abdominal radiography revealed dilated gas and fluid filled intestinal loops proximal to the site of intussusception in four cases. Whereas two cases showed dilated gas and fluid filled intestinal loops and it was not possible to confirm to diagnose the cases as intussusception by radiography alone. Intussusception had characteristic sonographic appearance like alternative hypo and hyper echoic concentric rings in transverse scan. For intussusception ultrasonography was very much useful diagnostic tool, than plain radiography. In pyometra, plain radiography revealed a dense tubular structure which was extended up to caudal abdomen and increased soft tissue density were the strong findings of open and closed pyometra, for the further confirmation ultrasonography was done to see the characteristic ultrasonography signs like thickened hyper echoic uterine wall and hypochoic to anechoic lumen in open pyometra and convoluted tubular structure with a hypochoic to anechoic lumen in closed pyometra. In open pyometra ultrasonography was more useful than plain radiography. However, in closed pyometra ultrasonography and plain radiography has got equal diagnostic importance. For uterine disorders both plain radiography and ultrasonography were useful diagnostic tools than haematobiochemical parameters. In Cystitis, on plain radiography no specific radiographic observations were made. On ultrasonography it revealed a hyper echoic structure with acoustic shadows and thickened wall of the urinary bladder in five, out of six cases. However, asymmetrically enlarged prostate gland with hypo and hyper echoic parenchyma indicating the prostatic hyperplasia with thickened wall of the urinary bladder was seen in one case. Ultrasonography was more effective in diagnosis of cystitis and prostatic hyperplasia than plain radiography and haematobiochemical parameters.

**Keywords:** Radiography, ultrasonography, gastro-intestine, haemato-biochemical

### 1. Introduction

Abdominal affections are most frequently encountered in small animal practice (O'Brien, 1978) [22] and are the major causes of morbidity and mortality in the absence of precise diagnosis and treatment. The vague clinical signs associated with abdominal disorders make the diagnosis even more difficult. To narrow the gap between an accurate diagnosis and initiation of treatment, a number of diagnostic imaging modalities like radiography and ultrasonography are being employed.

Radiographic imaging is considered as an integral part of the diagnostic approach towards canine abdominal disorders. Radiography is use full for diagnosis of affections, which render anatomical change to the viscera there by providing an abdominal image on a radiograph. However, lack of contrast in the abdomen limit the precision of abdominal radiography (O'Brien, 1978) [22]. This can be overcome by contrast radiography, which may further enhance visualization and provide information regarding the functional status of some organs. However, radiography is hazards and more time consuming.

Ultrasonography is another imaging modality, which overcomes the disadvantages of radiography and may be useful in diagnosis of abdominal affections. It is rapid, non-invasive, non-discomfort, less expensive and reliable diagnostic tool as compared to other imaging techniques. Ultrasonography provides instant information about a wide range of body systems, the dynamic functions of organs, basic living anatomy and various physiological processes

(Goddard, 1995) [8]. It determines the shape, size, location, internal architecture and consistency of abdominal organs more accurately. Sonography being free from radiation burden allows repetitive examination without any discomfort to the animal, with enhanced application in critical cases also. It has lot of significance to diagnose various affections of gastrointestinal tract, urinary bladder, uterus, prostate and other abdominal organs. Bhadwal (1997) [2] and Satish (2001) [40] reported use of ultrasonography studies for canine abdomen in health and disease. They reported that ultrasound was an effective tool for visualization of various abdominal organs and was helpful in diagnosing varied abdominal affections *viz.*, intussusception, pyometra, cystitis and perineal hyperplasia in canines. Change in haematological and biochemical parameters, which indicate systemic disturbances, associated with abdominal disorders. So combined use of haematological and biochemical parameters with imaging modalities may help for correct diagnosis of abdominal disorders. No imaging modality is considered complete in itself. However, a planned use of various imaging techniques will enable for better treatment can be undertaken at an earlier stage with the higher potential for increased survival.

## 2. Materials and Methods

The present study was carried on 18 clinical cases of canines presented to Teaching Veterinary Clinical Complex, Veterinary College, Bidar. The study was carried out of either sex, aged between 1 month to 12 years and weighed 3 to 25kg. The canines suffering from abdominal disorders involving gastrointestinal tract, urinary bladder, uterus and prostate gland were recorded. Grouping was done according to system involved. (Table No 1). All the cases were subjected to systemic evaluation for diagnosis of the conditions.

**Table 1:** Details of technical programme of clinical study

Groups	Abdominal conditions	No. of canines in each group	No. of control animals
I	GIT conditions (Intussusceptions)	6	6
II	Genital conditions (Pyometra)	6	
III	UTI conditions (Cystitis with prostatic hyperplasia)	6	

Ultrasonography, plain and contrast radiography, haematological and biochemical parameters were evaluated on the day of clinical cases presented.

### 2.1 Clinical observation

Following parameters were recorded for each case

1. Duration of illness.
2. Severity of the condition.
3. Associated clinical symptoms *viz.*, anorexia, lethargy, depression, weight loss, emesis, enlargement of abdomen, polydypsia, polyurea, hematuria, vaginal discharge and icterus were recorded.

### 2.2 Radiography

Routinely for abdominal radiography Ventro-dorsal or right lateral or left lateral views were taken. Radiograph of abdomen were taken using a 200 mAs capacity X-ray machine. Radiographic factors were kept as per the case

requirement ranging from 20-30 mAs and 70-90 kVp at a constant focal distance of 90-100 cm with grid cassette. Based upon the size of the organ film size was selected. Processing of the film was done as per standard procedure.

## 2.3 Ultrasonography

### 2.3.1 Preparation of the animal for ultrasonography

The area to be scanned was prepared by clipping and shaving and cleaned to remove any grease or dirt. A coupling medium was applied liberally over the area to increase the skin-transducer contrast. In the present study ultrasonography was carried out using an ultrasound scanner? (a gray scale, real time, B- mode scanner) with 2-5MHz and 6-10MHz micro-convex transducer.

The choice of transducer was done based on the highest possible frequency used and smallest active element diameter to achieve adequate penetration care was taken that the having the organ of interest and the lesion to be within the focal zone of the transducer. The images were recorded on thermo graphic printing paper.

Abdominal ultrasonography was done following a systematic approach, with the animal in the recumbence as desired (lateral or dorsal) a body area from the coastal arch to the pelvic inlet shaved. Organs of interest were scanned in transverse, sagittal and dorsal planes to evaluate the interest architecture, boundaries, organs size, shape and position. The xiphoid, Linea Alba and pubis were used as the basic reference points. The scanning procedure followed in the present study was as per the procedure described by (Nyland et al., 1981) [21] The amplitude of the returning echoes (echogenicity) as visualized on two dimensional, gray-scale images, were classified as increased (hyperechoic), normal (isoechoic), decreased (hypo echoic) or absent (anechoic) when compared with the normal echo amplitudes for the organs.

## 2.4 Physiological observations

Canines of all the groups were observed for physiological parameters such as rectal temperature, respiratory and heart rate as follows.

### 2.4.1 Rectal Temperature (°F)

**Rectal temperature (°F)** was recorded in canines of all the groups on the day of presentation of the cases.

**2.4.2 Heart Rate (Beats/minute)** Heart rate (beats per min) was recorded in canines of all the groups on the day of presentation of the cases.

**2.4.3 Respiratory Rate (Breaths/minute)** Respiratory rate (breaths per min) was recorded in canines of all the groups on the day of presentation of the cases.

## 2.5 Haematological study

Blood samples were collected with 1 % EDTA from all the cases of canines on the day of presentation of the cases. The following haematological studies were carried out.

### 2.5.1 Haemoglobin (g/dl)

Haemoglobin was estimated by Sahli's haemoglobin meter as per the standard method recommended by Schalm *et al.* (1975) [27] on the day of presentation of the cases.

### 2.5.2 Total Leukocyte Count (x10<sup>6</sup>/μl)

Total leukocyte count was estimated on the day of presentation of the cases as per the standard procedure described by Jain (2000) [11] and the values were expressed in thousand cells per microliter of blood.

### 2.5.3 Total Erythrocyte Count (x10<sup>6</sup>/μl)

Total erythrocyte count was estimated on the day of presentation of the cases by procedure described by Schalm *et al.* (1975) [27] using Neubauer's slide and values were expressed in million cells per microliter of blood.

### 2.5.4 Differential Leukocyte Count (%)

Differential leukocyte count was done on the day of presentation of the cases by staining the blood smear with Giemsa stain and 100 leukocyte were counted using Battlement method as described by Jain (2000) [11].

## 2.6 Biochemical study

Biochemical study was carried out in the canines of all the groups using the serum samples collected on the day of presentation of the cases. The following biochemical studies were carried out.

### 2.6.1 Aspartate transaminase (IU/L)

Aspartate transaminase was estimated by auto analyser on the day of presentation of the cases. The values were expressed in international units per liter.

### 2.6.2 Alanine transaminase (IU/L)

Alanine transaminase was estimated by auto analyser on the day of presentation of the cases. The values were expressed in international units per liter.

### 2.6.3 Blood Urea Nitrogen (mg/dl)

Blood urea nitrogen was determined by mercury combining power method as described by Coles (1986) [41] on the day of

presentation of the cases. The values were expressed in mg/dl.

### 2.6.4 Creatinine (mg/dl)

Creatinine was estimated by autoanalyser on the day of presentation of the cases. The values were expressed in mg/dl.

## 2.7 Statistical analysis

The values were analysed statistically by different methods described by Snedecor and Cochran (1968) [31] using student 't' test.

## 3. Results

The present study was carried on 18 clinical cases of canines presented to Teaching Veterinary Clinical Complex, Veterinary College, Bidar. The study was carried out on animals of either sex, aged between 1 month to 12 years and weighing up to 3 to 25 kg. The canines were presented with vague clinical signs and suffering from abdominal disorders involving gastrointestinal tract, urinary bladder, uterus and prostate gland. The results of this study are presented as follows.

### 3.1. Physiological parameters

#### 3.1.1 Rectal Temperature (°F)

Comparison between control group and other groups revealed that the rectal temperature was significantly higher ( $p < 0.01$ ) in Group-II.

#### 3.1.2 Respiratory Rate (Breaths/minute)

There was no significant ( $P > 0.05$ ) difference in the respiratory rate value between the control group and other groups of the study.

#### 3.1.3 Heart Rate (Beats/minute)

There was no significant ( $P > 0.05$ ) difference in the heart rate of control group and other groups.

**Table 2:** Mean±SE values of physiological parameters in different group of animals at the time of case presentation

Parameter	Control	Group I	Group II	Group III
Rectal Temperature (°F)	102.40±0.42	102.40±0.30	104.17±0.22**	103.03±0.17
Respiratory Rate (Breaths/minute)	24.17±1.17	29.50±0.88	21.50±0.34	20.50±0.43
Heart Rate (Beats/minute)	75.30±1.50	81.60±1.58	72.50±1.23	74.67±1.42

\*\*Mean bearing differ significantly ( $p < 0.01$ ) from control group

## 3.2 Haematological parameters

### 3.2.1 Haemoglobin (g/dl)

Comparison between control group and other groups revealed that the haemoglobin was significantly lower in Group-1 ( $p < 0.01$ ) and in Group-11 ( $p < 0.05$ ) when compared to control group. Whereas, group III animals had normal haemoglobin level.

### 3.2.2 Packed Cell Volume (%)

Comparison between control group and other groups revealed that the packed cell volume (%) was significantly lower in Group-1 ( $p < 0.05$ ) when compared to other groups. There was no significant ( $p < 0.05$ ) difference between control and group II and group III.

### 3.2.3 Total Erythrocyte Count (10<sup>6</sup>/μl)

There was no significant ( $p < 0.05$ ) difference in the erythrocyte count levels between the control group and other

groups.

### 3.2.4 Total Leukocyte Count (10<sup>6</sup> μl)

Comparison between control group and other groups revealed that the leukocyte count (10<sup>6</sup> μl) was significantly lower in Group-1 ( $p < 0.01$ ), higher in Group-II ( $p < 0.01$ ) and in Group-III ( $p < 0.05$ ) when compared to control group.

### 3.2.5 Neutrophil (%)

Comparison between control group and other groups revealed that the neutrophil (%) was significantly higher ( $p < 0.05$ ) in Group-11 when compared to other groups.

### 3.2.6 Lymphocyte (%)

Comparison between control group and other groups revealed that the lymphocyte count was significantly lower ( $p < 0.05$ ) in Group-11 when compared to other groups.

### 3.2.7 Monocyte (%)

There was no significant ( $P>0.05$ ) difference in the Monocyte level between the control group and other groups.

### 3.2.8 Eosinophil (%)

There was no significant ( $p < 0.05$ ) difference in the eosinophil level between the control group and other groups.

**Table 3:** Mean $\pm$ SEM values of haematological parameters in different group of animals at the time of case presentation

Parameter	Control	Group I	Group II	Group III
Haemoglobin (g/dl)	13.50 $\pm$ 0.76	8.85 $\pm$ 0.39**	10.20 $\pm$ 0.37*	12.41 $\pm$ 0.35
Packed Cell Volume (%)				
Total Erythrocyte Count ( $10^3 \mu\text{l}$ )	6.37 $\pm$ 0.18	5.78 $\pm$ 0.27	6.44 $\pm$ 0.23	7.35 $\pm$ 0.42
Total Leukocyte Count( $10^3 \mu\text{l}$ )	10.27 $\pm$ 0.29	8.43 $\pm$ 0.21**	27.30 $\pm$ 0.9**	16.92 $\pm$ 1.91*
Neutrophil (%)	70.68 $\pm$ 1.35	67.35 $\pm$ 1.35	81.67 $\pm$ 0.74**	74.16 $\pm$ 0.98
Lymphocyte (%)	25.67 $\pm$ 1.40	31.34 $\pm$ 1.42	17.17 $\pm$ 0.61**	24.15 $\pm$ 1.16
Monocyte (%)	0.71 $\pm$ 0.01	0.68 $\pm$ 0.02	0.5 $\pm$ 0.01	0.66 $\pm$ 0.04
Eosinophil (%)	0.71 $\pm$ 0.02	0.65 $\pm$ 0.02	0.64 $\pm$ 0.01	01 $\pm$ 0.137

\*\*Mean bearing \*\* differ significantly ( $p < 0.01$ ) from control group

\*Mean bearing differ significantly ( $p < 0.05$ ) from control group

### 3.3 Biochemical Parameters

#### 3.3.1 Alanine transaminase (IU/L)

Comparison between control group and other groups revealed that the alanine transaminase was significantly higher in Group-1 ( $p < 0.01$ ) and in Group-III ( $p < 0.05$ ) when compared to control group.

#### 3.3.2 Aspartate transaminase (IU/L)

There was no significant ( $p < 0.05$ ) difference in the aspartate transaminase value between the control group and other groups.

#### 3.3.3 Blood Urea Nitrogen (mg/dl)

Comparison between control group and other groups revealed that the blood urea nitrogen was significantly higher ( $p < 0.01$ ) in Group-II.

#### 3.3.4 Creatinine (mg/dl)

Comparison between control group and other groups revealed that the creatinine was significantly higher ( $p < 0.01$ ) in Group-II, when compared to other groups.

**Table 4:** Mean $\pm$ SEM values of biochemical parameters in different group of animals at the time of case presentation

Parameter	Control	Group I	Group II	Group III
Alanine Transaminase(IU/L)	55.50 $\pm$ 2.98	61.67 $\pm$ 0.08**	65.84 $\pm$ 2.13	66.82 $\pm$ 1.40
Aspartate Transaminase (IU/L)	38.67 $\pm$ 2.64	39.50 $\pm$ 1.08	47.00 $\pm$ 1.98	41.62 $\pm$ 0.62
Blood Urea Nitrogen (mg/dl)	17.60 $\pm$ 0.80	17.60 $\pm$ 0.80	25.26 $\pm$ 1.22**	23.28 $\pm$ 1.97
Creatinine (mg/dl)	0.92 $\pm$ 0.12	1.12 $\pm$ 0.14	1.78 $\pm$ 0.07**	1.25 $\pm$ 0.09

\*\*Mean bearing \*\* differ significantly ( $p < 0.01$ ) from control group

\*Mean bearing differ significantly ( $p < 0.05$ ) from control group

### 3.4 Affections of Gastrointestinal tract

Amongst affections of gastrointestinal tract six cases were of intussusception

#### 3.4.1 Intussusception

##### 3.4.1.1 Clinical Examination

Six pups (5 males and female) were presented with a history of anorexia, depression, passed foul smelling black watery faeces, rectal prolapse and vomiting. The mean body weight 5.50 $\pm$ 0.22 kg and pups were suffering from parvo viral infection.

##### 3.4.1.1.2 Radiological Examination

Plain abdominal radiographs were taken in right lateral view for all the cases. Out of six cases, four cases showed the dilated gas and fluid filled intestinal loops proximal to the intussusception. In other two cases, fluid filled and dilated intestinal loops throughout the intestine were observed. Plain radiography proved to be moderately diagnostic value in intussusception and confirmative diagnosis was done by other diagnostic aids.

##### 3.4.1.1.3 Ultrasonography Examination

Ultrasonography of intestine was done by using 8MHz micro convex transducer. It was observed that an alternative hypo and hyper echoic concentric rings were important sonographic

findings. In sagittal plane multiple parallel, alternative hypo and hyper echoic lines were observed. These findings were typical of an intussusception observed in all the cases. However, it was not possible to diagnose the site of intussusception by ultrasonography. Laparotomy was done for the confirmation of site of intussusception, which revealed intussusception at ileocolic region.

### 3.5 Affections of genital system

In the present study, six cases of pyometra were diagnosed.

#### 3.5.1 Pyometra

Six dogs were presented with clinical signs like anorexia, high fever, emesis, polydipsia, polyuria, abdominal distension and history of mating in the recent past and average age of 7.83 $\pm$ 0.40 years. Mean body weight was 21.33 $\pm$ 0.88 kg. Out of six dogs, (case no 1) a dog with purulent vaginal discharge was diagnosed as open pyometra, in five out of six dogs there was no history of vaginal discharge and on palpation of abdomen soft fluid filled structure was evident in the caudal abdomen. It was not possible to diagnose the closed pyometra based on clinical signs alone. However, other methods were used for the further confirmation.

#### 3.5.2 Radiological Examination

Plain radiography of the abdomen was taken in lateral view



for all the cases presented with the history of pyometra. A dense tubular structure which was extended up to caudal abdomen and increase soft tissue density in caudal abdomen was the strong findings of plain radiography.

### 3.5.3 Ultrasonography Examination

All cases were subjected to ultrasonography examination by using 5MHz micro convex transducer. Thickened hyper echogenic uterine wall and hypochoic to anechoic lumen, were seen in open pyometra. Convulated tubular structures with a hypochoic to anechoic lumen were sonographic findings of closed pyometra.

### 3.6 Affections of urinary tract

In the present study five cases of cystitis and one of cystitis with prostatic hyperplasia were diagnosed.

#### 3.6.1 Cystitis

Six male dogs were presented with clinical signs like pyrexia, foul smelling turbid urine, dysuria, hematuria and frequent attempts to micturate scanty urine. The mean age of the group was  $6.16 \pm 0.47$  years and mean body weight of  $20.6 \pm 0.33$  kg.

#### 3.6.2 Radiological Examination

In five cases, on plain radiography of the abdomen in a lateral view, urinary bladder was not visible clearly. In one case increased soft tissue density of bladder was observed. Whereas, no specific radiographic observations were found in any of the cases.

#### 3.6.3 Ultrasonographic Examination

Ultrasonography of urinary bladder was done by using 4MHz and 8MHz micro convex transducers. A hyperechoic structure with acoustic shadows and thickened wall of the urinary bladder, were the sonographic findings in five out of six cases. However, asymmetrically enlarged prostate gland with hypo- and hyperechoic parenchyma indicated the prostatic hyperplasia with cystitis in one case.

### 3.7 Normal radiographic appearance of intestine

Plain lateral and ventro-dorsal radiographs of abdomen, gas and fluid were seen within the lumen of the intestine.

### 3.8 Normal Ultrasonographic appearance of intestine

Ultrasonographic scanning of intestine was done by using 8MHz micro convex transducer, it revealed that alternative hyper and hypo-echogenicity layers were recorded.

### 3.9 Normal radiographic appearance of uterus

On plain lateral and ventro-dorsal radiographs of abdomen, uterus was not seen.

### 3.10 Normal Ultrasonographic appearance of uterus

Ultrasonographic scanning of uterus was done, there were no visibility of normal uterus.

### 3.11 Normal radiographic appearance of urinary bladder

On plain lateral radiographs of abdomen, urinary bladder seen as an opaque soft tissue structure, oval in male dogs and ellipsoid in bitches .

### 3.12 Normal Ultrasonographic appearance of urinary bladder

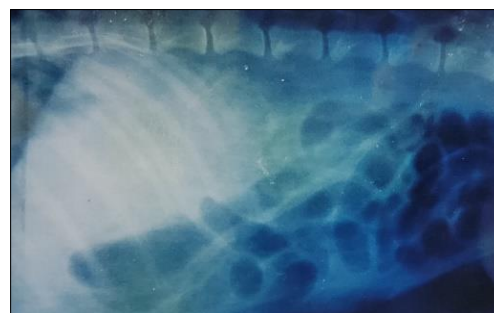
Ultrasonographic scanning of urinary bladder was done by using 4MHz transducer, urinary bladder was seen as an anechoic structure with smooth, well defined wall.

### 3.13 Normal radiographic appearance of prostate gland

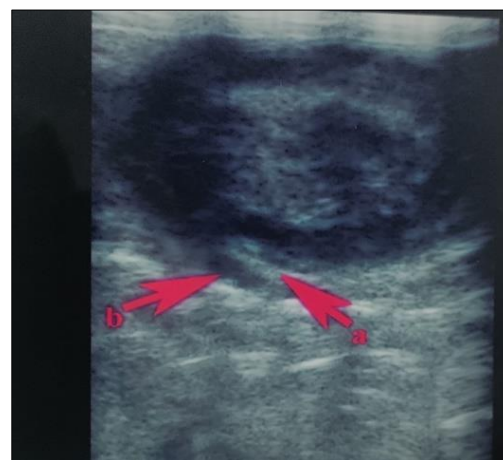
On plain radiographic in ventro-dorsal view a prostate gland was not visible in dog.

### 3.14 Normal Ultrasonographic appearance of prostate gland

Ultrasonographic scanning of prostate gland was done by using 4MHz transducer, homogenous, echogenic echo texture with small anechoic areas were seen.



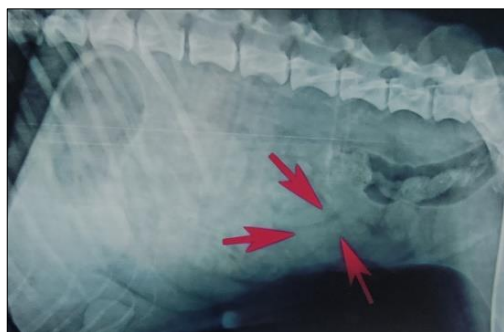
**Fig 1:** Lateral abdominal radiography of dog showing, gas and fluid filled loops of bowel, posterior to the intussusception mass



**Fig 2:** Abdominal Ultrasonographic transverse view, concentric hypochoic (b, arrow showing) and hyperechoic (a, arrow showing) rings in a dog



**Fig 3:** Resected segment of ileocolic (arrow showing) intussusception in pup



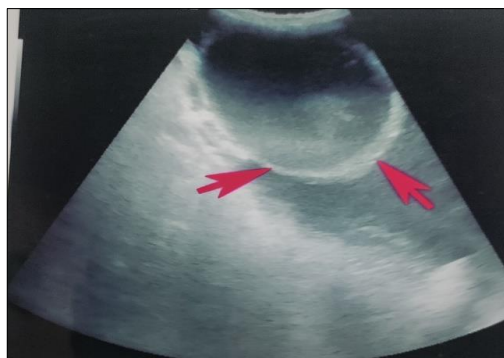
**Fig 4:** Lateral abdominal radiographic view showing coiled uterine masses in caudal abdomen (arrow showing) of a bitch



**Fig 5:** Abdominal Ultrasonographic view of abdomen in a bitch, thickened hyperechoic uterine wall (arrow showing) filled with hyper and hypochoic fluid



**Fig 6:** Note the invisibility of the bladder wall in lateral abdominal radiographic view in a dog



**Fig 7:** Abdominal Ultrasonographic view of urinary bladder depicting diffusely thickened wall, (arrow showing) hyperechoic structure in a dog

presented to Teaching Veterinary Clinical Complex, Veterinary College and Bidar. The canines were presented with vague clinical signs and suffering from abdominal disorders involving gastrointestinal tract, urinary bladder, uterus and prostate gland were considered. The results of this study are discussed under following headings.

#### 4.1 Physiological parameters

##### 4.1.1 Rectal Temperature (°F)

In pyometra (group II) rectal temperature was increased, it might be due to septicemia or infection. Similar findings were observed by various authors (Arvind 2002 and Singh *et al.*, 2010) [1, 30]. In group I and group III rectal temperature remained within the normal limit from that of the control group.

##### 4.1.2 Respiratory Rate (Breaths/minute)

Respiration rate was within the normal limit in all the groups. However, Jones (1986) [13], Arvind (2002) [1] and Kamble *et al.* (2004) [14] observed mild dyspnoea in the cases presented with pyometra.

##### 4.1.3 Heart Rate (Beats/minute)

No significant difference in the heart rate was observed in group I, group II and group III from that of control group. However, Jones (1986) [13], Arvind (2002) [1], Tiwari *et al.* (2004) [36] and Siddalingswamy and Sunilchandra (2004) [29] observed tachycardia in the cases presented with pyometra.

#### 4.2 Haematological parameters

##### 4.2.1 Haemoglobin (g/dl)

Decreased haemoglobin was recorded in group I and group II. In group I decreased haemoglobin which might be due to loss of erythrocyte through the damaged gut and impaired bone marrow production associated with parvoviral enteritis. Similar findings were recorded by Hall and Simpson (2000) [9]. In group II, Decreased haemoglobin might be due to septicaemia or toxemia associated with pyometra, which were potent suppressors of the bone marrow, similar findings were observed by Feldman (2000) [6], and Kamble *et al.* (2004) [14]. In group III haemoglobin value were within the normal limit and did not vary significantly from control group.

##### 4.2.2 Packed Cell Volume (%)

No significant difference in the packed cell volume was observed, in group II and group III animals from that of control group. However, decreased packed cell volume was observed in group I animals, which might be due to damaged gut and impaired bone marrow production associated with parvoviral enteritis. Similar findings were recorded by Hall and Simpson (2000) [9] in dogs presented with intussusception.

##### 4.2.3 Total Erythrocyte Count (10<sup>6</sup>/μl)

Total erythrocyte count was within the normal limit in all the groups and did not vary significantly from that of control group. Sokolowski (1986) [32], and Shobha *et al.* (2008) [28] observed non-significant change in the total erythrocyte count in the animals presented with pyometra.

##### 4.2.4 Total Leukocyte Count (10<sup>6</sup>/μl)

In group I, total leukocyte count was decreased. It might be due to damaged gut and impaired bone marrow production

#### 4. Discussion

The present study was carried on 18 clinical cases of canines

associated with parvoviral enteritis, similar findings were observed by Hall and Simpson (2000)<sup>[9]</sup>. However, Shobha *et al.* (2008)<sup>[28]</sup> observed leucocytosis in intussusception. In the present study, leucocytosis was observed in pyometra (group II). Similar findings were recorded by Roberts (1988)<sup>[42]</sup>, Arvind (2002)<sup>[1]</sup>, Siddalingswamy and Sunilchandra (2004)<sup>[29]</sup>, Tiwari *et al.* (2004)<sup>[36]</sup>, and Singh *et al.* (2010)<sup>[30]</sup> in cases presented with pyometra. In group III, animals presented with cystitis also shown leucocytosis in present study. Similar findings were recorded by earlier worker (Ling, 2000 and Pallavi *et al.*, 2006)<sup>[19, 24]</sup>.

#### 4.2.5 Neutrophil (%)

In pyometra (group II) neutrophil a was observed. It might be due to infection. Similar findings were observed by earlier worker Roberts (1988)<sup>[42]</sup>, Arvind (2002)<sup>[1]</sup>, Sunita Nauriyal and Sanjib (2008)<sup>[34]</sup> and Singh *et al.* (2010)<sup>[30]</sup>. In group I and group III neutrophil count did not differ significantly from control group and values were within the normal limit.

#### 4.2.6 Lymphocyte (%)

In pyometra (group II), relatively lymphocyte was decreased, it might be due to increased neutrophil count. However, Sunita Nauriyal and Sanjib (2008)<sup>[34]</sup> recorded the normal lymphocyte. In group I and group III lymphocyte count did not differ significantly from control group and values were within the normal limit.

#### 4.2.7 Monocyte (%)

The monocyte count was within the normal limit in all groups and monocyte value did not differ significantly from control group.

#### 4.2.8 Eosinophil (%)

The eosinophil count was within the normal limit in all groups and eosinophil value did not differ significantly from control group.

### 4.3 Biochemical Parameters

#### 4.3.1 Alanine transaminase (IU/L)

Significantly higher alanine transaminase was recorded in the animal presented with cystitis (group III) when compared to control group. However, it was within the normal limit. No Significant difference in the alanine transaminase was observed in group I and group II, when compared to control group.

#### 4.3.2 Aspartate transaminase (IU/L)

The aspartate transaminase was within the normal limit in all groups and aspartate transaminase did not differ significantly from control group.

#### 4.3.3 Blood Urea Nitrogen (mg/dl)

Significantly higher blood urea nitrogen was recorded in the pyometra (group II). It might be due to dehydration and pre-renal uremia. Similar findings were observed by earlier workers (Feldman, 2000 and Pallav Shekhar *et al.*, 2008)<sup>[6, 23]</sup>. Blood urea nitrogen values were within the normal limit in group I and group III and value did not differ significantly from control group.

#### 4.3.4 Creatinine (mg/dl)

Significantly higher creatinine was observed in pyometra

(group II), it might be due to dehydration and pre-renal uremia. Similar findings were observed by Feldman (2000)<sup>[6]</sup>. However, Pallav Shekhar *et al.* (2008)<sup>[23]</sup> observed no significant changes in the creatinine value in cases presented with pyometra. Creatinine values were within the normal limit in the group I and group III and value did not differ significantly from control group.

### 4.4 Affections of Gastrointestinal tract

#### 4.4.1 Intussusception

Six cases of intussusception were diagnosed based on clinical examination, radiography, ultrasonography and haemato-biochemical parameters.

##### 4.4.1.1 Clinical Examination

Pups were presented with a history of anorexia, depression, passing foul smelling black watery faeces, rectal prolapse, vomiting and pups were suffering from paravo viral infection. Similar clinical signs were observed by Ganesh *et al.* (1991)<sup>[7]</sup>, and Vineet Kumar *et al.* (2012)<sup>[38]</sup>. However, Vineet Kumar *et al.* (2012)<sup>[38]</sup> reported that acute enteritis or gastroenteritis were the most predisposing factor for intestinal intussusception.

##### 4.4.1.2 Radiological Examination

On plain abdominal radiographs, four cases showed the dilated, gas and fluid filled intestinal loops proximal to the intussusception. This was agreement with earlier workers observed by (Kelvin and Hester, 2000 and Shobha *et al.*, 2008)<sup>[26, 28]</sup>. In other two cases, fluid filled and dilated intestinal loops throughout the intestine were observed. On the other hand Feeney *et al.* (1982)<sup>[5]</sup> reported fluid filled bowel loops and contrast radiograph showed apparent narrowing of the bowel. Williams and Reichle (1993)<sup>[39]</sup> observed intussusception as a dense soft tissue mass in the central abdomen, with thin lines of gas surrounding the intussusception and gas between intussusception's and intussusceptum in plain radiography. Pitcher (1994)<sup>[43]</sup> observed intussusception as a residence mass in the right mid abdomen caudoventral to the 13th rib at the level of L3 Riedesel (1998)<sup>[44]</sup> recommended the use of barium enema for colonic intussusceptions which could not see on survey radiographs.

##### 4.4.1.3 Ultrasonographic Examination

Ultrasonography of intestine showed, an alternative hypo and hyper echoic concentric rings in transverse scan. In sagittal plane multiple parallel, alternative hypo and hyperechoic lines were observed and these findings were typical of an intussusception. Similar observation was reported by earlier worker (Kantrowitz *et al.*, 1988; Lamb 1990 and Shobha *et al.*, 2008)<sup>[15, 18, 28]</sup>.

### 4.5 Affections of genital system

In the present study, six cases of pyometra were diagnosed based on clinical examination, plain radiography and ultrasonography and haematobiochemical parameters.

#### 4.5.1 Pyometra

##### 4.5.1.1 Clinical Examination

Dogs presented with clinical signs like anorexia, high fever, emesis, polydypsia, polyuria, abdominal distension and history of mating in the recent past were suspected for



pyometra. Out of six dogs, a dog with purulent vaginal discharge was diagnosed as open pyometra. Similar observation were reported by earlier worker (Feldman, 2000, Arvind, 2002, Singh *et al.*, 2008; Kamble *et al.*, 2004; Tiwari *et al.*, 2004 and Singh *et al.*, 2010) [6, 45, 1, 14, 36, 30] In five out of six dogs there was no history of vaginal discharge and on palpation of abdomen soft fluid filled structure was evident in the caudal abdomen were suspected for closed pyometra. Similar observations were reported by earlier worker (Pallav Shekhar *et al.*, 2008 and Sunita Nauriyal and Sanjib 2008) [23, 34].

#### 4.5.1.2 Radiological Examination

Plain radiography of the abdomen proved to be very much useful diagnostic technique for diagnosis of pyometra. Uterine enlargement, which was extended up to caudal abdomen and increase in soft tissue density were the strong findings on plain radiography. Similar observations were reported by earlier worker (O'Brien, 1978, Feeney and Johnston, 1998; Feldman 2000 and Singh *et al.*, 2008) [22, 3, 6, 45] in dogs suffering from pyometra.

#### 4.5.1.3 Ultrasonographic Examination

Ultrasonographic examination of the case presented with open pyometra showed, a thickened hyperechoic uterine wall and hypochoic to anechoic lumen. Similar observations were reported by earlier worker (England and Allen, 1990) [46]. A tubular structure with a hypochoic to anechoic lumen was sonographic findings in the cases of closed pyometra. Similar observations were reported by earlier worker (Rivers and Johnston, 1991 and Singh *et al.*, 2008) [26, 45].

#### 4.6 Affections of urinary tract infection

In the present study, five cases of cystitis and one of cystitis with prostatic hyperplasia were diagnosed based on clinical examination, plain radiography and ultrasonography and haematobiochemical parameters.

##### 4.6.1 Cystitis

###### 4.6.1.1 Clinical Examination

Male dogs were presented with clinical signs like pyrexia, foul smelling turbid urine, dysuria, hematuria and frequent attempts to micturate scanty urine. Similar clinical signs were observed by Pallavi *et al.* (2006) [24].

**4.6.1.2 Radiological Examination:** On plain radiography, urinary bladder was not clearly visible this might be due to due to an empty bladder, insufficient intra-abdominal contrast. Similar findings were observed by Kelvin and Hester, 2000 [16].

###### 4.6.1.3 Ultrasonographic Examination

Ultrasonography of urinary bladder depicting hyperechoic structure with acoustic shadows and thickened wall of the urinary bladder in all the cases. These results are in agreement with several earlier workers (Bhadwal, 1997, and Suarez *et al.*, 2002) [2, 33]. However, asymmetrically enlarged prostate gland with hypo and hyperechoic parenchyma and thickened wall of the urinary bladder were observed in a case presented with cystitis with prostatic hyperplasia. Similar finding were observed by several earlier workers (Lamb, 1990; Johnston *et al.*, 1991, Kevin Kealy *et al.*, 2005) [18, 12, 17].

**4.7 Normal radiographic appearance of intestine** Plain lateral and Ventro-dorsal radiographs of abdomen showing gas and fluid filled intestine. Similar findings also observed by Kevin Kealy *et al.* (2005) [17].

#### 4.8 Normal Ultrasonographic appearance of intestine

Ultrasonographic scanning of intestine was done by using 8MHz micro convex transducer, it revealed that alternative hyper and hypo-echogenicity layers. Similar findings observed by Lamb (1990) [18].

#### 4.9 Normal radiographic appearance of uterus

In present study, on plain lateral and Ventro-dorsal radiographs of abdomen, uterus was not visible. It is due to radio density of the uterus was similar to soft tissue and hence could not be differentiated from small intestine on survey radiographs. Similarly, Ackerman (1981) [1] stated that the uterus usually will not be seen in the normal dog unless there was enlargement by a pathologic process.

#### 4.10 Normal Ultrasonographic appearance of uterus

Ultrasonography of uterus was done by using 5MHz transducer, there was invisibility of normal uterus. It might be due to its small size and lower echogenicity compared to bowel loops. Similar findings observed by Ackerman (1981) [1] and Rivers and Johnston (1991) [26].

#### 4.11 Normal radiographic appearance of urinary bladder.

On plain lateral radiographs of abdomen, urinary bladder seen as an opaque soft tissue density, oval in male dogs and ellipsoid in bitches. Similar findings observed by O'Brien (1978) [22] and Park (1998) [25].

#### 4.12 Normal Ultrasonographic appearance of urinary bladder

Ultrasonographic scanning of urinary bladder was done by using 4MHz transducer. Urinary bladder was seen as an anechoic structure with smooth, well defined wall. Similar findings observed by Bhadwal, 1997 [2].

#### 4.13 Normal radiographic appearance of prostate gland

On plain radiography in ventro-dorsal view a prostate gland was not visible in dog. Finco (1980) [47] stated that radiography of normal prostate gland was not visible in most dogs, especially neutered dogs.

#### 4.14 Normal Ultrasonographic appearance of prostate gland

Ultrasonographic scanning of prostate gland was done by using 8MHz transducer, homogenous, echogenic echo texture with small anechoic areas were seen. Similar findings observed by earlier workers (Feeney *et al.*, 1985, and Johnston *et al.*, 1991) [4, 12].

### 5. Summary

The present study was carried on 18 clinical cases of canines presented to Teaching Veterinary Clinical Complex, Veterinary College and Bidar. Either sex, aged between 1 month to 12 years and weighing 3 to 25 kg. With vague clinical signs and suspected to be suffering from affections involving different abdominal organs. All the animals were subjected to systemic evaluation for diagnosis of the disease condition, including determination of haematobiochemical



parameters, abdominal radiography and ultrasonography. The affections of gastrointestinal tract, genital and urinary tract infection were subjected to systemic evaluation and diagnostic imaging. With the help of this modulates abdominal affections were diagnosed as intussusception, pyometra, cystitis and prostate hyperplasia in the present study. In affections of gastrointestinal tract, cases presented with history and clinical signs like anorexia, depression, passed foul smelling black watery faeces, rectal prolapse and vomiting cases were suspected for intussusception. On plain abdominal radiography revealed dilated gas and fluid filled intestinal loops proximal to the intussusception in some cases. However, in two cases, it was not possible to confirm as intussusception by radiography alone. In transverse scan an alternative hypo and hyper echoic concentric rings, were characteristic sonographic findings of intussusception.

Physiological parameters like rectal temperature, respiratory rate and heart rate were fluctuated within the normal limit and there was no significant difference in all physiological parameters. In haematological parameters haemoglobin, packed cell volume and total leukocyte count were significantly decreased and total erythrocyte and differential leukocyte count were within the normal limit. Biochemical parameters like alanine transaminase, aspartate transaminase, blood urea nitrogen and creatinine fluctuated within the normal limit and there was no significant difference in biochemical parameters.

The cases presented with pyometra had clinical signs like anorexia, high fever. Emesis, polydypsia, polyuria, abdominal distension, and history of mating in the recent past. One dog with purulent vaginal discharge was diagnosed as open pyometra based on clinical sign. In five out of six dogs there was no history of vaginal discharge and on palpation of abdomen soft fluid filled structure was evident in the caudal abdomen. It was not possible to diagnose the closed pyometra based on clinical signs and palpation. However, other methods were used for the further confirmation. A dense tubular structure which was extended up to caudal abdomen and increase soft tissue density in caudal abdomen was the strong findings of open and closed pyometra in plain radiography. For the further confirmation ultrasonography was done, it revealed thickened hyperechoic uterine wall and hypoechoic to anechoic lumen were seen in open pyometra. Convoluted tubular structure with a hypoechoic to anechoic lumen were sonographic findings of closed pyometra. In open pyometra ultrasonography was more useful than plain radiography, however in closed pyometra ultrasonography and plain radiography have got equal diagnostic importance.

Physiological parameters like, respiratory rate and heart rate were fluctuated within the normal limit and there was no significant difference in physiological parameters, except rectal temperature, which showed increased significantly in dogs presented with pyometra. Haematological parameters like haemoglobin and lymphocyte were significantly decreased. Whereas, total leukocyte count, neutrophil, were significantly increased and other haematological parameters like packed cell volume, et al erythrocyte count were within the normal limit and there was no significant difference. Biochemical parameters like blood urea nitrogen and creatinine were significantly increased and other biochemical parameters like alanine transaminase, aspartate transaminase were within the normal limit and there was no significant difference.

The cases presented with urinary tract infection had history and clinical signs like glycosuria, foul smelling turbid urine, dysuria, haematuria and frequent attempts to micturate scanty urine, based on these clinical signs cases were suspected for cystitis. On plain radiography no specific observations were made. On ultrasonography it revealed a hyperechoic structure with acoustic shadows and thickened wall of the urinary bladder in five, out of six cases. However, asymmetrically enlarged prostate gland with hypo and hyperechoic parenchyma indicated the prostatic hyperplasia with thickened wall of the urinary bladder.

Physiological parameters like rectal temperature, respiratory rate and heart rate were fluctuated within the normal limit and there was no significant difference in all physiological parameters. In haematological parameters, total leukocyte count was significantly decreased and other parameters like haemoglobin, packed cell volume, total erythrocyte count and differential leukocyte count were within the normal limit and there was no significant difference. Biochemical parameters like creatinine were significantly increased and other biochemical parameters like alanine transaminase, aspartate transaminase and blood urea nitrogen were within the normal limit and there was no significant difference.

#### **Based on above findings following conclusions were made,**

1. For intussusception ultrasonography was very much useful diagnostic tool, when compared to plain radiography. The plain radiography was more useful than haematobiochemical parameters.
2. For uterine disorders both plain radiography and ultrasonography were useful
3. Diagnostic tools than haematobiochemical parameters.
4. Haematobiochemical observations may be used as an aid to diagnosis the pyometra in bitch.
5. Ultrasonography was more effective in diagnosis of cystitis and prostatic hyperplasia than plain radiography and haematobiochemical parameters.
6. In present study ultrasonography was found to be more effective diagnostic tool, for diagnosis of canine abdominal disorders than other diagnostic technique like plain radiography.

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