CHAPTER V
SUMMARY AND CONCLUSIONS

The present study entitled “Ultrasonographic studies for diagnosis of clinical abdominal pathological conditions in dogs” was conducted at department of veterinary surgery and radiology. College of Veterinary Science and Animal Husbandry, Junagadh Agriculture University, Junagadh. The study was implemented from July 2017 to May 2018.

In present study 100 clinical cases were screened out of either sex or age out of which 25 cases were, selected with their clinical signs and showing any abnormal pathological condition and confirmation of the pathological conditions were made by the help of ultrasonography as well as with haemato-biochemical status of animal. All the selected 25 animals underwent surgical operation.

In this present study all 100 cases were divided according to their age, sex and breed. Ultrasound was performed in all 100 dogs and most affected age group suffering from abdominal pathologies was of between 1 – 5 years of age 42 (42 %) followed by 5 – 8 years of age 31 (31 %), 0 -1 years of age 19 (19 %) and 10 year and above 8 (8 %).

Present study indicated that the dogs of either sex were affected however female population was more 59 (59 %) affected than that of male population 41 (41 %).

In present study pathological conditions were found in different variety of breeds which includes Pomeranian spitz (17 %), Labrador retriever (28 %), German shepherd (17 %), Doberman pinscher (4 %), Spitz (3%), Saint bernard (6 %), Lhasa apso (2 %), Cocker spaniel (1 %) Golden retriever (1 %), Non-descript (14 %), Pug (1 %), Rottweiler (4 %) and Beagle (2 %). Out of which most affected breeds was Labrador retriever (28 %), Pomeranian spitz (17 %), German shepherd (17 %) and Non-descript (14 %).

In present study the ultrasound scanning of whole abdomen in dogs was performed in either sagittal or in transverse plane by e-Saote ultrasonography machine with multi frequency probes. Curvilinear scan head with variable frequency (2.5-5 MHz) and linear scan head with frequencies of (8-10 MHz). The ultrasound scans of abdominal organs viz, liver, gall bladder, spleen, kidneys,
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stomach, intestine, urinary bladder, prostate, uterus and ovaries in male and female dogs were obtained. Any alteration in the shape, size, place and echogenicity of these abdominal organs and the presence of any associated mass or space occupying lesion were diagnosed based on the ultrasonographic findings.

In present study left lateral lobe, left medial lobe and right lateral lobe of liver were scanned at left hypochondric region, xiphoid region and right hypochondric region respectively. Greater curvature of stomach was scanned at xiphoid region. Duodenum and jejunum were scanned at right hypochondric and umbilicus region. Spleen was scanned at left flank region. Colon was scanned at umbilicus region and uterus, urinary bladder and prostate were scanned at pubic region.

Haemato biochemical examination was performed in 25 dogs. For the estimation of haematological parameters; Haemoglobin (Hb), Packed Cell Volume (PCV), Total Erythrocytes Count (TEC), Total Leucocytes Count (TLC), differential leucocyte count (DLC) were performed by using haematology analyser (Abacus Vet 5, diatron, Hungary) and for biochemical parameters Alanine Transaminase (ALT), Aspartate Transaminase (AST), Alkaline Phosphatase (AKP), Total Protein (TP), Blood Urea Nitrogen (BUN), Creatinine, Pancreatic Lipase and Total Bilirubin were performed by using biochemical analyser (Dia-chem 240 plus, Diatek, China). The haemato-biochemical values of 25 dogs compared with normal reference values (Merck manual). Any alterations in haemato-biochemical values were recorded and corroborated with ultrasonographic interpretations for the clinical diagnosis made thereof.

In present study, Ultrasonographic, clinicophysiological and haemato-biochemical examination of abdomen was performed in 25 dogs, out of which 8 were male and 17 were females of 2 months to 13 years of age. The diverse affection diagnosed ultrasonographically in dogs were pyometra (10 cases), cystoliths (3 cases), cystic endometrium hyperplasia and pyometra complex (4 cases), intestinal obstruction (2 cases), ventral hernia (3 cases), intussusception (1 case), renomegaly and gall bladder stone (1 case) and benign prostatic hyperplasia (1 case). These dogs underwent sterilisation operation as a surgical regimen indicated for the treatment of these surgical affections.

In present study 10 cases of pyometra were diagnosed ultrasonographically. Common ultrasonographic examination revealed dilation of uterus with convoluted
uterine horns filled with homogenous anechoic to hypoechoic fluid. Hyperechoic thickened uterine wall and hyperechoic mobile internal echoes in the lumen of uterus seen. Diagnosis of pyometra was very easy on ultrasonography due to visualization of walled sacculation.

In present study 2 cases were diagnosed with liver cirrhosis and pyometra. Ultrasonography of liver revealed shrunken hyperechoic liver lobes, irregular hyperechoic hepatic margins, periportal fibrosis and abdominal organs were floating in anechoic ascitic fluid.

In present study the most common complaint reported in dogs suffering with pyometra was vaginal discharge, which is suggestive of open pyometra. Anorexia, depression, polydipsia, polyuria, dullness, diarrhoea, vomiting and hard palpable mass on abdominal palpation were the other clinical signs reported in the present study.

In present study mean rectal temperature 103.15 ± 0.25 (100.2 – 103), respiratory rate 31.1 ± 1.27 (18 -34) and heart rate 111.4 ± 3 (70 -120) was found towards elevated level in pyometric cases.

In present study of pyometra anaemia with decrease mean values of haemoglobin (Hb) 9.3 ± 1.04 (11.9 – 18.9), Packed Cell Volume (PCV) 28 ± 2.41 (35 – 57) and Total Erythrocyte Count (TEC) 5.27 ± 0.53 (5 – 7.87), neutrophilic 78.04 ± 4.14 (58 - 80) leucocytosis 29342 ± 2992 (5000 – 14000) with shift to left and mild lymphopenia 14.36 ± 4.38 (8 -25) observed.

In present study mean serum Alanine Transaminase (ALT) 64.213 ± 9.3 (10 – 109), mean Aspartate Transaminase (AST) 53.30 ± 7.58 (10 – 62), mean total protein 6.12 ± 0.72 (5.4 – 7.5) and pancreatic lipase 30.2 ± 2.79 (0 – 50) were within normal range, mean hypoalbumenia 2.12 ± 0.25 (2.3 – 3.1) found however mean elevation in Alkaline Phosphatase (AKP) 142. 25 ± 11.30 (1 – 114), Blood Urea Nitrogen (BUN) 32.09 ± 5.77 (8 – 28), creatinine 2.67 ± 1.05 (0.5 – 1.7) and total bilirubin 1.418 ± 0.46 (0 – 1) observed.

In present study 3 cases of cystoliths were observed ultrasonographically. Common ultrasonographic findings of urinary bladder revealed single to multiple, round to oval shaped, small sizes hyperechoic structures with distinct acoustic shadowing. Ultrasonography was found beneficial for locating the stones and evaluating the status of urinary bladder in dogs.
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Stranguria, dysuria, dribbling of urine, polyuria, haematuria, abdominal pain, anorexia, dehydration, depression or lethargy and emaciation were clinical findings in case of cystoliths.

In present study of cystoliths mean rectal temperature 102.16 ± 1.03 (100.2 – 103), respiratory rate 31.66 ± 4.40 (18 -34) and heart rate 109 ± 9.5 (70 -120) were within normal range.

Mean values of haemoglobin (Hb) 13.33 ± 2.71 (11.9 – 18.9), Total Erythrocyte Count (TEC) 7.20 ± 1.13 (5 – 7.87) and monocyte count 4.33 ± 2.33 (2 – 10) were within normal range however Packed Cell Volume (PCV) values 49.63 ± 8.10 (35 – 57) were towards increase line, leucocytosis 23973 ± 6262.95 (5000 – 14000), neutrophilia 87.66 ± 4.25 (58 - 80) and lymphopenia 6.33 ± 3.17 (8 - 25) were also observed.

In present study of cystoliths mean serum Alanine Transaminase (ALT) 45.87 ± 13.44 (10 – 109), mean Aspartate Transaminase (AST) 25.41 ± 7.10 (10 – 62), mean Alkaline Phosphatase (AKP) 72.36 ± 7.18 (1 – 114), Total Protein (TP) 5.83 ± 0.44 (5.4 – 7.5), albumin 2.82 ± 0.33 (2.3 – 3.1), pancreatic lipase 34 ± 2 (0 – 50) and total bilirubin 0.37 ± 0.08 (0 – 1) were within normal range however mean Blood Urea Nitrogen (BUN) 71.33 ± 21.75 (8 – 28) and creatinine 5.22 ± 3.41 (0.5 – 1.7) level were found elevated.

In present study cystic endometrial hyperplasia pyometra complex was observed in 4 cases ultrasonographically. Ultrasonographic findings of uterus revealed distension of uterus, sacculated tubular uterine horns filled with anechoic to hypoechoic fluid. Hyperplastic and thickened endometrial wall with multiple, rounded, small to large sized, smooth marginated cavities filled with anechoic fluid presented on the sacculated uterine horns were cysts. Acoustic enhancement was also present below the anechoic cyst.

Anorexia, foul smelling vaginal discharge, vomition, polydipsia, polyuria, dehydration, tonicity of uterus and rough body coat were observed as a clinical signs.

Mean heart rate was found normal 106.75 ± 7.70 (70 -120) however rectal temperature 102.3 ± 0.5 (100.2 – 103), and respiratory rate 32 ± 2.08 (18 -34) were found towards higher line.

In present study of CEHPC, mean values of Haemoglobin (Hb) 7.44 ± 1.84 (11.9 – 18.9), Packed Cell Volume (PCV) 21.66 ± 5.39 (35 – 57) and Total Erythrocyte Count (TEC) 3.43 ± 0.80 (5 – 7.87) were markedly decrease however
leucocytosis $34892.5 \pm 4316.17$ (5000 – 14000), neutrophilia $88.47 \pm 0.35$ (58 -80) and lymphopenia $5.5 \pm 0.64$ (8 -25) were observed.

In present study mean Alanine Transaminase (ALT) $75.5 \pm 4.94$ (10 – 109), mean pancreatic lipase $29 \pm 3.34$ (0 – 50) and mean total bilirubin $0.82 \pm 0.04$ (0 – 1) was within normal range with mean hypoalbumenina $2.4 \pm 0.18$ (2.3 – 3.1). Mean increase in Aspartate Transaminase (AST) $72 \pm 11.23$ (10 – 62), Alkaline Phosphatase (AKP) $156 \pm 12.49$ (1 – 114) observed and Blood Urea Nitrogen (BUN) $23.62 \pm 4.61$ (8 – 28), Creatinine (CR) $1.55 \pm 0.17$ (0.5 – 1.7) and total protein (TP) $7.6 \pm 0.234$ (5.4 – 7.5) were towards higher levels.

In present study intestinal obstruction was observed in 2 cases ultrasonographically. Ultrasonographic findings showed dilation of intestinal lumen with static hypoechoic to hyperechoic luminal contents creating acoustic shadowing distally and surrounded by hypoechoic mildly thicken intestinal wall.

All the animals immediately after creation of intestinal obstruction showed mild signs of discomfort like pain while abdominal palpation and dyschezia. Anorexia, vomition, dehydration, dullness and depression were observed as clinical signs.

In present study mean values of Haemoglobin (Hb) $15 \pm 0.8$ (11.9 – 18.9), Packed Cell Volume (PCV) $45.1 \pm 3.1$ (35 – 57), Total Erythrocyte Count (TEC) $6.85 \pm 0.15$ (5 – 7.87), lymphocyte count $17.5 \pm 1.5$ (8 - 25), monocyte count $2 \pm 0$ (2 – 10) and eosinophil count $1 \pm 0$ (0 – 9) were within normal range however leucocytosis $31150 \pm 2150$ (5000 – 14000) and mild neutrophilia $79.5 \pm 1.5$ (58 -80) observed.

In present study mean Alanine Transaminase (ALT) $48.57 \pm 2.13$ (10 – 109), mean Alkaline Phosphatase (AKP) $55.15 \pm 7.85$ (1 – 114), Blood Urea Nitrogen (BUN) $19 \pm 3$ (8 – 28), Creatinine (Cr) $0.74 \pm 0.23$ (0.5 – 1.7), pancreatic lipase $19.5 \pm 1.5$ (0 – 50) and total bilirubin $0.52 \pm 0.26$ (0 – 1) were within normal range however elevation of mean serum Aspartate Transaminase (AST) $110.64 \pm 10.35$ (10 – 62), total plasma protein $10.46 \pm 0.69$ (5.4 – 7.5) and albumin $4.42 \pm 0.27$ (2.3 – 3.1) observed.

In present study ventral hernia was observed in 3 cases ultrasonographically. Ultrasonography of ventral hernia revealed multiple hypoechoic intestinal loops with anechoic to hypoechoic lumen coming out from hyperechoic hernial ring due to discontinuity of abdominal muscles underneath the skin.
Anorexia, vomition, dyschezia, emaciation, dullness and depression observed as a clinical signs.

In present study of ventral hernia rectal temperature 101.63 ± 0.3 (100.2 – 103), respiratory rate 32.66 ± 2.6 (18 -34) and heart rate were 111.66 ± 1.6 (70 -120) within normal range.

In present study haemoglobin (Hb) 13.66 ± 1.20 (11.9 – 18.9), Packed Cell Volume (PCV) 55 ± 2.64 (35 – 57), Total Erythrocyte Count (TEC) 6.85 ± 0.45 (5 – 7.87), lymphocyte count 16 ± 2.30 (8 -25) and monocyte count 4.66 ± 0.33 (2 - 10) were within normal range however leucocytosis 18456 ± 1355 (5000 – 14000) and neutrophilia 76.33 ± 2.18 (58 -80) observed

In present study Alanine Transaminase (ALT) 30.2 ± 10.38 (10 – 109), Aspartate Transaminase (AST) 18.93 ± 8.2 (10 - 62), Alkaline Phosphatase (AKP) 81.46 ± 19.23 (1 – 114), Blood Urea Nitrogen (BUN) 12.85 ± 2.76 (8 - 28), pancreatic lipase 19 ± 3.60 (0 – 50) and total bilirubin 0.32 ± 0.08 (0 – 1) were within normal range however decrease level of creatinine 0.37 ± 0.09 (0.5 – 1.7), total protein 3.41 ± 0.10 (5.4 – 7.5) and albumin 1.81 ± 0.07 (2.3 – 3.1) were observed.

In present study intussusception was observed in 1 case ultrasonographically. Ultrasonography findings of the intestine revealed dilatation of intestinal wall and absence of intestinal peristalsis movement. Concentric hypoechoic and hyperechoic intestinal rings characterised as “archers target” or “bulls eye” in transverse section and as a series of linear hyperechoic and hypoechoic streak or sausage like appearance in sagittal section. In the diagnosis of intussusception, ultrasonography is more appropriate.

In present study anorexia, recurrent prolapse, chronic vomition, haemorrhagic mucous and faeces coming out from rectum, dehydration and painful elongated mass felt on abdominal palpation were observed as a clinical signs.

In present study heart rate 106 (70 -120) was within normal range however rectal temperature 103 (100.2 – 103) and respiratory rate 33 (18 - 34) were towards higher levels.

In present study decrease in haemoglobin (Hb) 6.5 (11.9 – 18.9), Packed Cell Volume (PCV) 30 (35 – 57) and Total Erythrocyte Count (TEC) 4.96 (5 – 7.87) observed however leucocytosis 28090 (5000 – 14000), neutrophilia 93.4 (58 - 80) and lymphocytopenia 3.6 (8 - 25) also seen.
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In present study serum level of Alanine Transaminase (ALT) 60 (10 – 109), Aspartate Transaminase (AST) 35 (10 – 62), Total Protein (TP) 6 (5.4 – 7.5), pancreatic lipase 37 (0 – 50) and total bilirubin 0.87 (0 – 1) were found within normal range however elevation of Alkaline Phosphatase (AKP) 256 (1 – 114), Blood Urea Nitrogen (BUN) 60 (8 – 28), creatinine 2 (0.5 – 1.7) and hyperalbumenina 4 (2.3 – 3.1) observed.

In present study benign prostatic hyperplasia and cyst observed in 1 case. Ultrasonography of the pubic region revealed a diffusely enlarged, homogenous hypoechoic echotexture spherical in shape was prostate which consisting of 2 clear anechoic fluid filled cavities was found as intra-prostatic cysts surrounded by hypoechoic and heterogeneous prostatic parenchyma.

Haematuria, constipation, dullness, depression, anorexia and lethargy observed as clinical signs.

In present study respiratory rate 30 (18 -34) and heart rate 110 (70 -120) was within normal range however rectal temperature 102.8 (100.2 – 103) was towards increasing range.

In present study lower values of haemoglobin (Hb) 9.2 (11.9 – 18.9), Packed Cell Volume (PCV) 29.7 (35 – 57) and Total Erythrocyte Count (TEC) 4.66 (5 – 7.87) observed. There were no alteration in lymphocyte count 13.9 (8-25) however leucocytosis 16200 (5000 – 14000) and neutrophilia 83.4 (58 -80) observed.

In this present study Alanine Transaminase (ALT) 50.43 (10 – 109), pancreatic lipase 37 (0 – 50) and total bilirubin 0.4 (0 – 1) were within normal range however increase values of Aspartate Transaminase (AST) 75.41 (10 – 62), Alkaline Phosphatase (AKP) 172.1 (1 – 114), Blood Urea Nitrogen (BUN) 36 (8 – 28), and creatinine observed 2.26 (0.5 – 1.7). Decrease value of total protein 5.28 (5.4 – 7.5) and albumin 2.07 (2.3 – 3.1) was found.

In present study gall bladder stone and renomegaly was found in 1 case. Ultrasonography of gall bladder revealed anechoic and elongated gall bladder filled with anechoic bile. A hypoechoic uniform biliary sludge was seen which gravitates to the dependent portion of the gall bladder. A single, small, hyperechoic, rounded structure seen which was attached to the base of thickened, hyperechoic gall bladder wall was a gall stone. An acoustic shadow observed on the ultrasound scan.
In present study renomegaly found with cholelith. Ultrasonography of left flank revealed enlarged kidney with hyperechoic renal pelvis, anechoic to hypoechoic medulla, hyperechoic cortical infiltration with increased cortical to medullar diameter.

In present study anorexia, dullness, depression, oedema of all four limbs, pain on palpation, abnormal gait and bulging of abdomen observed as clinical signs.

In present study rectal temperature 102 (100.2 – 103), respiratory rate 25 (18 -34) and heart rate 93 (70 -120) were within normal range.

In present study Haemoglobin (Hb) 14 (11.9 – 18.9), Packed Cell Volume (PCV) 39.75 (35 – 57), Total Erythrocyte Count (TEC) 7.81 (5 – 7.87), lymphocyte count 17 (8 -25), monocyte count 5 (2 – 10) were within normal range however leucocyte count 12610 (5000 – 14000) and neutrophil count 77 (58 -80) were towards higher values.

In present study Alanine Transaminase (ALT) 37.36 (10 – 109), Aspartate Transaminase (AST) 28.17 (10 – 62), Blood Urea Nitrogen (BUN) 16.2 (8 – 28), pancreatic lipase 37 (0 – 50) and total protein 5.66 (5.4 – 7.5) were within normal range.

In present study elevated level of Alkaline Phosphatase (AKP) 325.4 (1 – 114), creatinine (Cr) 1.73 (0.5 – 1.7) and total bilirubin 3 (0 – 1) found along with decrease level of albumin 2.02 (2.3 – 3.1).

Ultrasonography was an efficient tool for diagnosis of gastrointestinal affections including intestinal obstruction and intussusception.

There was an intimate coincidence between clinical picture, biochemical results and ultrasonography in cases of uterine diseases such as pyometra and CEHPC. The clinical picture and biochemical results allowed the diagnosis of uterine affection, while ultrasonography determined specifically the nature of such disease. Ultrasonography was superior to clinical examination and biochemical analyses in recognizing uterine affections.

Clinical examination of the prostate and with rectal palpation with assisted caudodorsal abdominal pressure, shifting the gland to the pelvic inlet allowed tentative diagnosis of prostatic affections, but the precise extent of such conditions could only be determined ultrasonographically.

We can safely recommend the use of ultrasonography in veterinary medicine, because it provides non-invasive or minimally invasive means for assessment of...
abdominal and pelvic cavities and its organs beside more precision in accomplishment of exact diagnosis.

The following conclusion can be drawn from present study:

- Anechoic to hypoechoic uterine lumen, hyperechoic mobile internal echoes and thick uterine wall were key features for diagnosis of pyometra by ultrasonography in affected dogs.

- Shrunken hyperechoic liver lobes, irregular hyperechoic hepatic margins with ascitic fluid were indicative of liver cirrhosis as shown by ultrasonography.

- Ultrasonographic studies revealed that hyperechoic echogenicity with acoustic shadowing were an indicative sign of urinary calculi.

- “Archers target” or “bulls eye” appearance of intestine was a characteristic findings of intussusception in transverse section.

- Linear hyperechoic and hypoechoic “streak” or “sausage” like appearance of intestine were typical diagnostic findings for intussusception in sagittal section.

- The clinical and haematobiochemical findings observed in the animals were found in accordance to the pathology involved as revealed in ultrasonographic findings in studied dogs.

- The ultrasonographic examination of abdomen provided diagnosis of pyometra, liver cirrhosis, cystoliths, ventral hernia, cystic endometrial hyperplasia- pyometra complex, gastrointestinal obstruction, intussusception, benign prostatic hyperplasia and gall bladder stone in all affected dogs.

- The ultrasonography has been found reliable, non-invasive imaging modality to detect any pathological condition, space occupying lesions or masses associated with the abdominal organs in dogs undergoing surgical operation.