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Ultrasonographic features and surgical management of prostatic abscess in twelve (12) dogs

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Abstract
Prostatic affections comprising chiefly of prostatic abscess was recorded in 12 male dogs of different breeds in present study. These animals had a common history of dribbling of urine, pyuria, dysuria, fever, alopecia, gynaecomastia and usually the animals were either cryptorchid or monorchid, with mean age of 7.15 years. The animals were anaemic with leucocytosis and thrombocytopenia. Gray scale real time B-mode ultrasonography showed multiple hypoechoic circumscribed areas with echogenic contents in one or both the lobes of prostate gland. The ultrasonographic features were strongly suggestive of prostatic abscess which was confirmed on ultrasound-guided aspiration. Culture of pus sample showed presence of *Escherichia coli*, *Staphylococcus spp*., and *Klebsiella spp*. Surgery was undertaken for removal of retained and ectopic testicles. In few cases prostatic abscess was drained intra-operatively and partial prostatectomy was performed in one animal. Antibiotics were injected directly into prostate gland at the location of prostate abscess after drainage of pus under ultrasound guidance. All these animals were subjected to repeated scans over a period of three months and all showed significant regression in size of prostate abscess.

Keywords: Abscess, dogs, prostate, ultrasonography

Introduction
Prostatic abscess is an uncommon finding in dogs and often a complication of infected cyst or severe prostatitis. Cysts are found in approximately 15% dogs over 7 years or older and bacterial contamination is found in 42% of prostatic cyst [12]. Both acute and chronic infections occur in the canine prostate gland, usually as a result of ascent of normal aerobic urethral bacteria into a gland with benign prostatic hypertrophy. Prostate abscess can occur in association with septic prostatitis. *Escherichia coli* is the most common bacterial organism identified in dogs with bacterial prostatitis, followed by *Staphylococcus aureus*, *Klebsiella spp*., *Proteus mirabilis*, *Mycoplasma canis*, *Pseudomonas aeruginosa*, *Enterobacter spp*., *Streptococcus spp*., *Pasteurella spp*., and *Haemophilus spp*.[9] Ultrasonography is considered as an essential imaging modality to study prostatic conditions in dogs. Ultrasonography helps to differentiate radiographically identifiable prostatomegaly attributable to abscess or neoplasia from apparent prostatomegaly attributable to paraprostatic cyst [4]. Antibiotic therapy should be selected based on sensitivity of bacteria cultured from inflammatory exudates and on the ability of the antibiotic to diffuse into prostatic fluid in therapeutic concentrations [9]. However, US-guided percutaneous drainage of prostatic abscess and cysts appears to be a useful alternative to surgical intervention in select dogs. Castration is recommended in animals with prostate disorders as it reduces volume and size of prostate gland [9, 5].

Material and methods
The present study included 12 intact male dogs of different breeds and age presented to the Dr.Dog Pet hospital, Banjarahills, Hyderabad over a period of one year i.e from October 2016 to October 2017. Ultrasonography was performed in all the animals using convex (2-5 MHz) and/or linear (6-12 MHz) transducer ultrasound machine. Before performing ultrasound animals were prepared by cleaning dirt or grease and then clipping hair over caudal abdomen cranial to the testicles. Animals were restrained in dorsal recumbency and a coupling medium (gel) was applied over the area prepared to increase the skin transducer contact. Prostate gland was visualized caudal to the urinary bladder and assessed for any change in shape, size, echogenicity and architecture.
Ultrasound-guided aspiration and drainage of prostatic abscess was performed in eight dogs. Transducer was placed lateral to the preputial sheath to scan the prostate gland by tracing neck

Of urinary bladder and ultrasound beam was directed to scan the prostate gland and locate the lesion at minimum possible depth for fine needle aspiration. A biopsy needle of 22 G was attached to 5ml syringe and was advanced slightly oblique to the long axis of transducer through the skin into prostate gland at the location of lesion. When needle was seen in the middle of the lesion, moderate and rapidly repeated suction was applied by pulling the syringe plunger and simultaneously advancing the needle inside the lesion. The syringe and attached needle were removed from the prostate gland under negative pressure. The samples obtained by aspiration were sent for culture and sensitivity test. Antibiotic therapy should be selected based on sensitivity of bacteria cultured from inflammatory exudates and on the ability of the antibiotic to diffuse into prostatic fluid in therapeutic concentrations

Partial prostatectomy was performed in four dog. Surgical site was aseptically prepared by clipping the hair and operative site was shaved and scrubbed using povidone iodine surgical scrub. Animals were prepared for aseptic surgery and were sedated with intramuscular injections of Xylazine hydrochloride @ 1 mg/Kg body weight. Following induction with ketamine hydrochloride @ 10 mg/kg body weight, anaesthesia was maintained with intravenous infusion of propofol at the rate of 4 mg/kg body weight [7].

Dog was placed in dorsal recumbency and urethra was catheterized. Surgical site was aseptically prepared. Skin incision was given on the ventral abdomen deviating from the midline lateral to prepuce and extending to cranial pubis. Partial prostatectomy was performed to remove glandular parenchyma by giving an incision over prostatic capsule and elevating prostate. Digital breakdown of loculations for drainage of prostatic abscess along with prostatic parenchyma was performed after ligation of individual blood vessels supplying the glandular tissue. Prostatic urethra was examination for any leakage. Finally the ventral hemisphere of prostatic capsule was resected to allow closure of capsule over remaining glandular prostatic tissue which was omentalized. Abdominal muscles were sutured with number 2-0 polyglactin 910 in a single layer simple interrupted suture pattern. Subcutaneous fascia was sutured by polyglactin 2-0 using sub-cuticular suture pattern. Skin incision was closed with number 1-0 Nylon using cross mattress suture pattern.

Results and Discussion

The mean age of dogs diagnosed with prostate abscess was 7.15±0.77 year ranging from 4 to 11 years. The most commonly affected breed was Labrador Retriever (60%) followed by Pug, German Shepherd, Pomeranian and Boxer constituting 10% each. Duration of illness was one month in one dog with recurrent history of dysuria, pyuria and dribbling of urine. History of dysuria was present in six dogs with mean duration of two weeks. Four dogs had history of dribbling of urine for two days to two months. Three dogs had history of pyuria (2 days to 1 month) while one dog had blood in urine since three days. History of abdominal enlargement was present in 4 animals with mean duration of 26.75±14.08 days. Other clinical signs included alopecia (6/12), lethargy (2/12), decreased urine output (4/12), foul smelling urine (2/12), preputial sheath swelling (2/12) and fever (4/12).

Rectal temperature, heart rate and respiration rate were within normal range in all the animals except for four animals with rectal temperature of 103°F and 104°F, respectively. Mucous membrane was pale in two dogs, slightly congested in one dog and was normal in rest of the dogs. On physical exanimation it was found that seven animals were monorchid, three dogs had normal scrotal testicles and two dog was cryptorchid. On abdominal palpation, a mass was palpable in two dogs with abdominal distension. Severe patchy alopecia was seen in three dogs while three dogs had moderate alopecia. Gynaecomastia was present in seven dogs. Values of haematological examination revealed moderate anaemia (10.16±0.46 g/dL) and thrombocytopenia (161±42×10³ cells/µL). Packed cell volume (30.48±2.03%) was below the normal reference range. Leucocytosis (23±4×10³ µ/l) was also evident on haematology (Table.1). Values of biochemical parameters viz. ALT (36.87±10.63 U/L), AST (21.20±3.07 U/L), ALP (103.00±3.52 U/L), BUN (17.83±3.52 mg/dL) and Creatinine (1.35±0.26 mg/dL) were within normal reference range in all the animals (Table 2).

Table 1: Mean± SE values of various haematological parameters

Hb (g/dL)	PCV%	TLC (cells/µL)	N%	L%	E%	PLT (cells/µL)
10.16±0.46	30.48±2.03	23.00±4.12×10³	77.8±2.6	18.9±2.9	2.7±0.7	161.23±42.11× 10³

Table 2: Mean± SE values of various biochemical parameters

ALT (U/L)	AST (U/L)	ALP (U/L)	BUN (mg/dL)	CRT (mg/dL)
36.87±10.63	21.20±3.07	103.00±3.52	17.83±3.52	1.35±0.26

Prostatic abscess was diagnosed on ultrasonography in seven dogs with retained testicular tumour, three dogs with neoplastic ectopic testicle and two dogs with normal scrotal testicles. On gray scale, real time, B-mode ultrasonography the prostate gland was enlarged invariably in all the cases with mean size of 7.07×4.26±0.90×0.32cm (4.46×4.05cm to 9.50×5.22cm) in current study. Multiple circumscribed hypoechoic areas with well-defined wall and echogenic contents with mean size of 2.68×2.41±0.23×0.40cm (1.47×1.02cm to 3.64×2.67cm) were appreciable in both prostatic lobes in 11 dogs and only right prostatic lobe was involved in one animal. The ultrasonographic features were strongly suggestive of prostatic abscess as shown in "Figure 1-3". The margins of hypoechoic pockets were well defined and regular in four animals and irregular in six animals. Rest of prostatic parenchyma had homogenous echogenicity in all the animals.

Prostate abscess was aspirated or drained per-cutaneously under ultrasound guidance in eight dogs. The volume of pus drained from prostate abscess in these five dogs was 70ml, 20ml, 15ml, 10ml, 8ml, 5ml, and 3ml respectively. The pus was moderately thick, foul smelling, light yellowish to light greenish and blood tinged in few cases. Collected samples were sent for culture and sensitivity test (CST). CST was performed in eight animals in which prostatic abscess were drained. The results of culture and sensitivity test as shown in Table.3.

Table 3: Results of culture and sensitivity test of pus sample drained from prostate gland.

Condition	Organism	Sensitive Antibiotic	Resistant Antibiotic
Prostate abscess (Monorchid dog)	*Staphylococcus* spp.	Amoxicillin, Gentamycin, Streptomycin and Ciprofloxacin	Chloramphenicol, Ciprofloxacin and Tetracycline
Prostate abscess (Cryptorchid dog)	*Escherichia coli*	Colistin, Gentamycin and Gatifloxacin	Ciprofloxacin, Ofloxacin, Cotriomoxazole, Clindamycin, Ampicillin, and Amoxicillin
Prostate abscess and normal testicles (Dog with normal scrotal testicles)	*Klebsiella* spp.	Gatifloxacin, Norfloxacin, Ofloxacin, Ampicillin, Amoxicillin, Tobramycin and Erythromycin	Colistin, Cefuroxime, Clindamycin, Cotriamoxazole, Doxycycline, Neomycin and Ciprofloxacin

Partial prostatectomy was performed in four dogs with enlarged prostate gland along with prostate abscess. Prostate gland was enlarged in size and pus filled when examined intra-operatively. The prostatic abscess was drained intra-operatively as show in "Figure 4-6" and volume of pus drained was 45ml, 10ml, 8ml and 6ml respectively. Following aspiration of pus, partial resection of the glandular prostatic parenchyma was employed during surgery. In all animals antibiotic was injected into hypoechoic pockets after drainage of pus under ultrasound-guidance. The animals were scanned repeatedly after a gap of ten days for one to two months and then every month upto six months and; the regression in the size of hypoechoic pockets i.e. prostate abscess was monitored. The animals showed good response to the topical administration of antibiotics and showed gradual regression of the prostate abscess. Animals recovered smoothly from anaesthesia after surgery. The post-operative treatment included administration of broad spectrum antibiotic, analgesic and multivitamin. Daily antiseptic dressing of incision line was done and skin sutures were removed after 10 days.

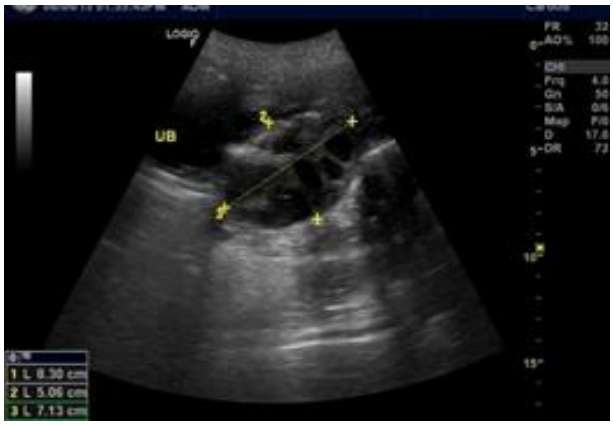

Fig 1: Ultrasonogram showing multiple Hypoechoic to anechoic circumscribed cavitary areas with echogenic contents in prostate gland

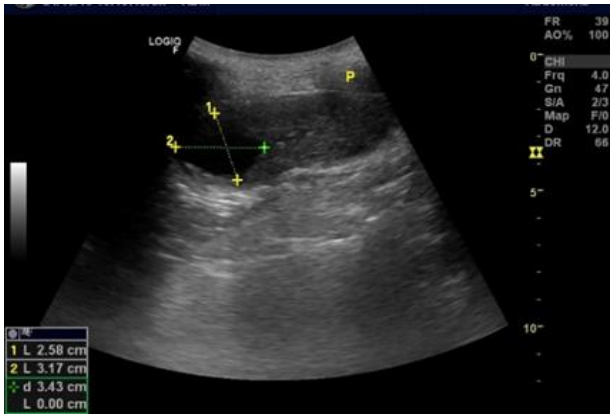

Fig 2: Ultrasonogram showing cavitary lesion in prostate gland

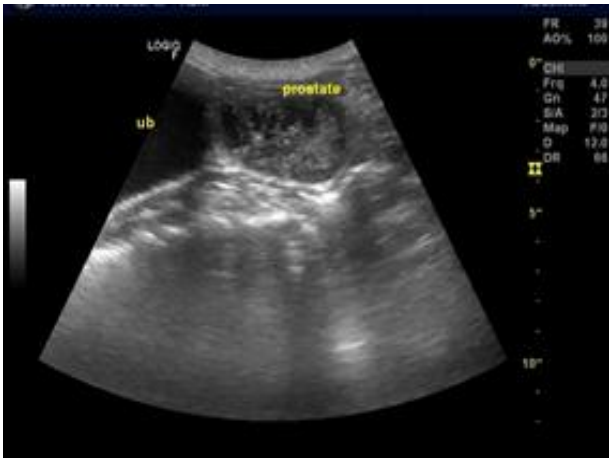

Fig 3: Ultrasonogram showing multiple small hypoechoic areas in right lobe of prostate gland

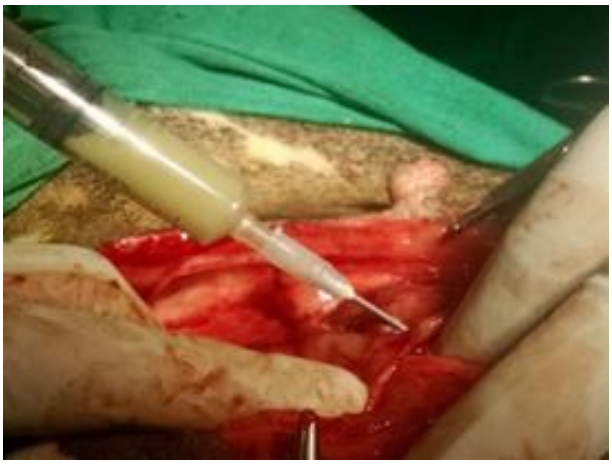

Fig 4: intra-operative drainage of pus from prostate gland

Fig 5: Drainage apparatus for intra-operative drainage Of prostate abscess from prostate gland

Fig 6: Intraoperative direct aspiration of pus from prostatic abscess

Prostatitis, prostatic abscesses, prostatic cysts, and prostatic neoplasia are uncommonly presented conditions in dogs [5]. However benign prostate hyperplasia (BPH) is a spontaneous and age-related disorder of intact male dogs, which occurs in more than 80% male dogs over 5 years of age. BPH may predispose intact male dogs to the development of abscesses and cysts. Prostate abscess was present in middle-aged dogs in current study. It is most frequently seen in dogs over six years old, often in association with benign hyperplasia [3]. In a study conducted on 177 cases of prostate diseases in dogs it was reported that 29% of dogs with a specifically identifiable prostatic disease had signs of systemic illness, 41% had signs of lower urinary tract disease, 28% had signs of gastrointestinal tract abnormalities, and 13% had signs of locomotor difficulty (10). Mostly animals with prostatic disorders are presented with signs of urinary tract disease (e.g., haematuria, urethral discharge, dysuria, stranguria, urinary incontinence) or GIT illness (e.g., tenesmus, constipation, ribbon-shaped stool) or systemic illness (e.g., inappetence, lethargy, weight loss). However, some animals may have no clinical signs [5].

Monorchidism, cryptorchidism, alopecia and gynaecomastia observed during physical examination were associated with sertoli cell tumour. In one study it was noticed that 5/17 dogs each with sertoli cell tumour was monorchid and cryptorchid respectively [17]. Sertoli cell tumour is often associated with feminization (19% cases) which seems to be result of an excessive oestrogen production by tumour [16]. Skin changes in 5/17 cases and feminism syndrome due to hyperestrogenism in 9/17 cases of sertoli cell tumour in dogs has been reported in one study [1, 6, 17]. Anaemia could be due to diminished production of erythrocytes in animals with sertoli cell tumour [19]. Leucocytosis could be associated with suppurative infection of prostate gland [14].

Ultrasonography represents much more sensitive imaging of prostate than radiology, facilitating very fine inspection of inner structure and morphology of the gland [8]. Trans-abdominal ultrasonographic approach is helpful in diagnosing any change in shape, size, architecture and echotexture of prostate gland. Ultrasonography is valuable in differentiating the parenchymal architecture of prostate as normal, focally hyperechoic, diffusely hyperechoic (associated with chronic inflammation and neoplasia), focally hypoechoic or anechoic which could be associated with cyst or abscess [4]. On ultrasound examination, prostatic abscess appears as hypoechoic to anechoic with an apparent thin capsule, whereas a cyst will be hypoechoic and shaped irregularly [5, 2, 15, 11]. Prostate abscess was diagnosed in seven animals with sertoli cell tumour in current study. Prostatic changes such as enlargement and suppurative inflammation could be associated with sertoli cell tumour [17]. Prostatic cavities including cysts and abscesses have also been reported as common lesions in cases of benign prostate hyperplasia (enlarged prostate), squamous metaplasia (prostate parenchyma with severe alterations) or severe prostatitis [11].

Parenchymal heterogeneity of prostate with presence of a big cavity and smaller cavities in prostate gland on ultrasound have been reported in earlier studies as well [11]. Squamous metaplasia of prostate is mainly related to excessive oestrogenic stimulation associated with sertoli cell tumour. [15, 11]. Squamous metaplasia can lead to cyst or abscess formation and prostatomegaly due to chronic condition [15]. Prostatic changes like enlargement and suppurative inflammation results from squamous metaplasia of the cuboidal epithelium of the prostate gland, urethra, ducts, and acini and keratin formed by the stratified squamous epithelial cells is shed into the ducts and acini leading to obstruction and the formation of cysts [17] .

Percutaneous ultrasound-guided drainage is considered as efficient tool for diagnosis and treatment of prostate abscess in dogs [3, 14, 2]. Appropriate antibiotic therapy can be started after performing culture and sensitivity test (CST) of pus drained from prostate [2, 13]. In chronic prostatitis, the blood-prostate barrier prevents the penetration of many drugs into the gland leading to selection of antibiotic agents on the basis of CST [11]. In current study growth was present in three out of six animals in which CST of pus sample was performed. The commonly isolated bacteria from prostatic fluid in dogs with suppurative prostatitis or prostate abscess included *Escherichia coli*, *Staphylococcus aureus*, *Proteus mirabilis*, *Klebsiella pneumonia*, *Steptococcus spp*. and *Mycoplasma spp*. [9, 10, 14].

Castration is recommended in animals with prostate disorders as it reduces volume and size of prostate gland [9, 5]. Development of prostatic disorders like benign prostatic hyperplasia, prostatitis, and cavitary lesions (prostatic abscesses or cysts) can be prevented by early castration in intact male dogs as it enhances treatment success and may prevent recurrence [5]. Dogs with severe prostatic abscesses or cysts and infections have been reported to be successfully treated by partial prostatectomy and castration, resulting in long-term resolution of disease [18]. In seven monorchid animals the size of surgically removed normal testicle was smaller than tumorous retained or ectopic testicle. Decreased size of contralateral testicle is associated with sertoli cell tumour [9]. The atrophy of uninvolved testicle is due to inhibition of secretion of gonadotrophic hormones from the anterior pituitary by excessive levels of oestrogen [4].

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