



Canine Populations in Vicinity are Propagating Canine Transmissible Venereal Tumour in Pakistan – A Pilot Study

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ABSTRACT

The aim of this study was to record the distribution and the spatial and temporal trends of canine transmissible venereal tumor (CTVT) in pet dogs; and identify the potential factors that are playing important role in disease spread. A questionnaire-based study was conducted to identify the conditions and circumstances of CTVT affected dogs that presented to veterinary practices over a 12-month period. The practices were convenience-sampled on the basis of voluntary participation. Forty practices were approached, and veterinarians from 24 practices agreed to participate. Data were provided on 96 original presentations, excluding revisits, of which 47.92% were intact males and 52.08% were intact females with the mean age of 3.98 years. Moreover, further 96 controls were selected from the same clinical practices with same parameters. Among the dogs meant for different purposes, guarding purpose dogs were found more affected (n=59). While among the dog breeds, Labrador were over-represented (n=26) followed by mongrel dogs (bully, n=23). In winter season, higher number of cases (n=34; from November to February) was recorded as compared to other seasons. To explore further important features, non-linear categorical PCA was employed. Prominently canine populations in the vicinity were found to be more varied. This is the first epidemiological study done in Pakistan that has identified some novel trends and circumstances regarding the CTVT.

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Authors' Contributions

FA, MMA and ZZ conceived the study. SN, RA, SAT, FA, SF, AI and HS collected and analyzed the data. MMA and ZZ supervised the study. HS and ZZ wrote the article.

Key words

Canine, Pakistan, Trends, Tumour, CTVT.

INTRODUCTION

Canine transmissible venereal tumour (CTVT), also named as Sticker's Tumour, infectious sarcoma or venereal granuloma, is a well-known tumour of domestic dogs (*Canis familiaris*) (Bautista-Gomez and Martinez-Castaneda, 2017; Castro *et al.*, 2017). This tumour is also well reported in his wild canine relatives like gray wolf

(*Canis lupus*), coyote (*Canis latrans*) (Das and Das, 2000). CTVT is a benign reticulo-endothelial tumour of histio-cytic origin that can physically transmit during coitus (Murgia *et al.*, 2006; Thangathurai *et al.*, 2008). CTVT is usually benign, but there are less than 5% cases that are reported with metastasis (Cizmeci *et al.*, 2012). Apart from the mating, it can also be transmitted between two dogs through licking, scraping, biting and sniffing of one's affected area (Rivera *et al.*, 2005). The singularity of CTVT rests in the fact that it is the only experimentally proved naturally existing tumour that acts as autonomous etiological agent (Mukaratirwa and Gruys, 2003;

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Murchison, 2008).

Canine breeding can be affected by many physiological and pathological etiologies. Several bacteriological and parasitological are notable in this matter. But the spread of a tumor in the canine population via contact is unique that further hinders the canine reproduction and dog breeding business. This contagious tumor infects dogs differently based on their keeping purpose such as only breeding purpose, companion, guard and sports. Only breeding purpose dogs were restricted to their cage and placed commercially for breeding or sale and purchase of litter. While the companion dogs are the dogs that were allowed to roam inside the house and only chained while going outside. Such dogs are kept for seasonal breeding and sale of litter as extra-activity. The guardian dogs are the dogs that are kept for only security purposes with seldom breeding practices for sale and purchase of litter. Sports dogs are the dogs that are kept for recreational purposes like fighting and hunting. Therefore, to completely understand, it is important to identify the group which has high tendency for this disease.

It has been observed that reproductive tract disorders are affecting the dog breeding in Pakistan (Athar *et al.*, 2001; Awan *et al.*, 2014). Among these, CTVT is a major threat to the reproductive efficiency of canines (Ortega-Pacheco *et al.*, 2003). Although there are some studies that focus on clinical aspects but in Pakistan there is scanty knowledge related to baseline parameters and distribution or trends which addresses the CTVT. Therefore this study was carried out to find different baseline parameters and distribution patterns associated with this disease in Pakistan.

MATERIALS AND METHODS

Forty mixed and small animal veterinary practices in Lahore District were conveniently sampled and approached to participate in the study on voluntary basis.

One questionnaire was intended for every case presentation to the clinic during the study period. Each

questionnaire, composed of a single page, had basic particulars of the dog, information related to breeding and other practices. To encourage the participation, the total number of questions was limited and all the close ended questions were included except age related question. The answers to the remaining close ended questions were designed in binary level categories that were further included in downstream statistical analyses. On the other hand, all the ages were categorized into different age groups and further divided into binary categories for univariate and multivariate analyses.

From questionnaires, data were maintained into Microsoft Excel spreadsheets. Data related to different variables were divided into different categories. On the other hand, data related to the location of all the cases was recorded with Global Positioning System (GPS, Garmin, Olathe, KS, USA) in WGS-84 datum. One to one dot distribution map was generated in Q-GIS 2.6.1 (Quantum-GIS Group). Geographical data of Lahore District consisting of boundaries and administrative town divisions were downloaded from the internet (<http://www.diva-gis.org/datadown> and http://lwmc.com.pk/company_profile.php). Continuous data were summarised using percentiles and mean, while nominal data were presented as counts or percentages, using R-statistical language package 'stats' (version 2.15.3). SPSS was utilized to apply chi square (χ^2) test (p -value <0.05) and non-linear categorical principal component analysis (CATPCA) to extract the most varied components. For CATPCA final model, Cronbach's alpha criterion was used as a measure of internal consistency (reliability). Components with eigenvalues greater than one were retained. The selected variables were further summarized and utilized in biplots with the objects to find out their associations.

RESULTS

Of 40 approached mixed and small animal veterinary practices, twenty four (60%) agreed to participate in the study. Among all the practices working in Lahore district,

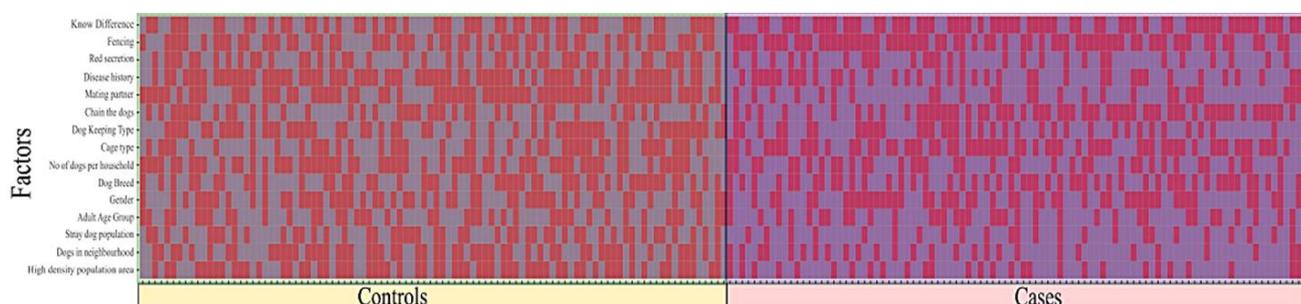


Fig. 1. Summarizing all the cases and controls regarding the factors. Red colour represents the Positive and purple represents the Negative.

24 represent a good proportion. After discarding the incomplete questionnaire, data was available for a total of 96 cases that were identified through clinical signs, histopathology, cytology or combination of these. For the application of various statistical tests 96 controls (other cases not having CTVT infection) were also collected from the same clinical practices (Table I, Fig. 1).

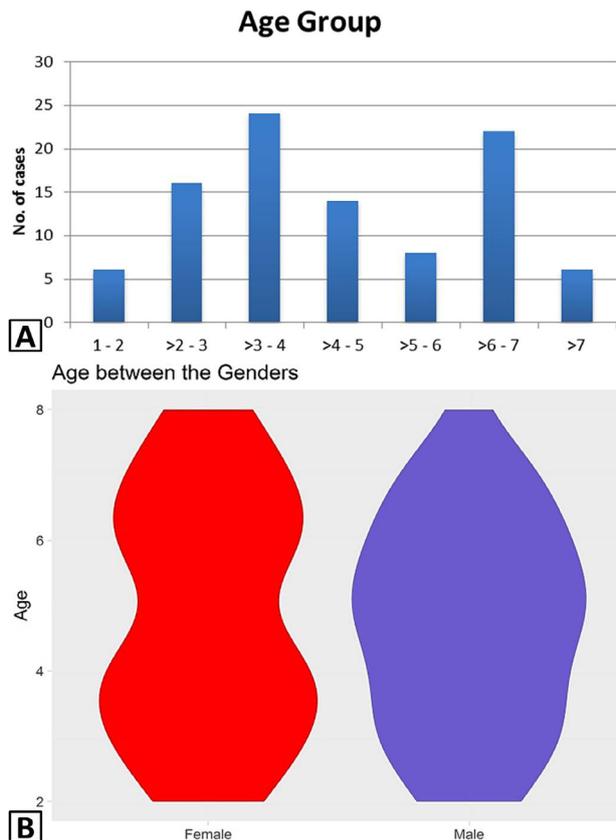


Fig. 2. A, Districution of number of cases among different age groups; B, frequency of age among both genders represented by violin plots.

All the affected dogs were adult with the mean age 3.98 years. Cases were further divided and stratified into seven groups with respect to their ages *i.e.* >1-2, >2-3, >3-4, >4-5, >5-6, >6-<7, and >7 or more (Fig. 2A). Highest number of cases were reported in the age group of >3-4 years, followed by the age group of >6-7 years. While the least number of cases were recorded among the age groups of 1-2 years and >7 years old. Age was further related to gender of the dogs that was described in Figure 2B.

Of the 96 case presentations, 46 (47.92%) were intact males and 50 (52.08%) were intact females. Occurrence of disease among the different breeds of dogs is given in Table I. Highest disease occurrence was found in Labrador followed by Mongrel dogs (Bully) with little difference.

Great dane, doberman, springer spanial and english pointer are the lowest reported diseased cases. Dog breeds were also further classified into two groups *i.e.* mongrels/local dog breeds and imported breeds (Fig. 3). In this classification, out of 96 case presentations, 49 mongrel dogs were found having slightly more frequency of CTVT. While the 47 imported dogs were found with CTVT.

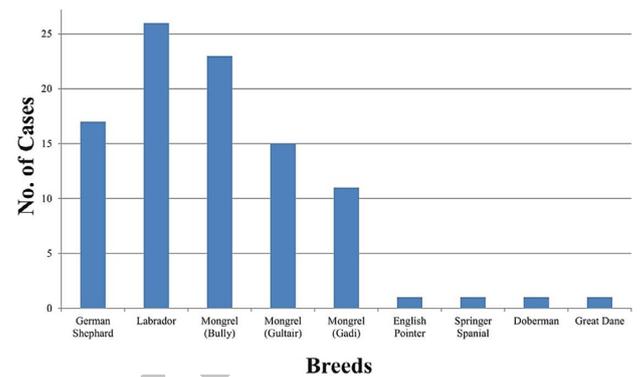


Fig. 3. Comparison of various breeds recorded as cases of CTVT from all the veterinary practices.

Registered dogs were further divided into 4 groups according to their keeping purpose *i.e.* only breeding purpose dogs, companion dogs, sports purpose dogs and guardian dogs. Of the 96 case presentations, there were 42.7% guarding purposes, 30.2% companion dogs, 18.75% sports and 8.3% only breeding purpose dogs.

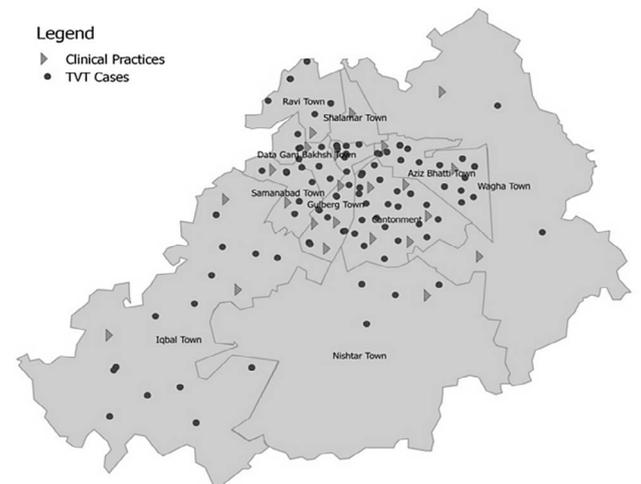


Fig. 4. Dot map representing the clinical practices and TVT cases in Lahore metropolitan.

The locations of clinical practices and CTVT cases were recorded and marked on the map (Fig. 4). There are total 9 towns and one cantonment area in Lahore District.

Table I.- Risk factors and chi square analysis of CTVT.

| S. No. | Risk factors | Levels | Case | Controls | P value | OR | CI 95% |
|--------|---|-----------|------|----------|-----------|------|-------------|
| 1 | Age | < 5 Years | 60 | 54 | 0.35 | 1.33 | 0.72 2.45 |
| | | > 5 Years | 36 | 42 | | | |
| 2 | Gender | Male | 46 | 45 | 0.89 | 1.03 | 0.611 1.75 |
| | | Female | 50 | 51 | | | |
| 3 | Chain/Restraining the dog | Yes | 38 | 55 | 0.019 | 0.51 | 0.291 0.9 |
| | | No | 58 | 41 | | | |
| 4 | Cage type | Separate | 35 | 53 | 0.0079 | 0.43 | 0.233 0.819 |
| | | Common | 61 | 43 | | | |
| 5 | Knowing the difference between normal discharge and clotted blood | Yes | 33 | 47 | 0.04 | 0.56 | 0.31 1 |
| | | No | 63 | 49 | | | |
| 6 | Dog breed | Imported | 47 | 45 | 0.87 | 1.08 | 0.5 1.8 |
| | | Mongrels | 49 | 51 | | | |
| 7 | Proper fence | Yes | 28 | 41 | 0.032 | 0.48 | 0.24 0.95 |
| | | No | 68 | 55 | | | |
| 8 | Purpose of Dog keeping | Guard | 59 | 41 | 0.014 | 2.01 | 1.13 3.5 |
| | | Pet | 37 | 55 | | | |
| 9 | Dogs in neighbourhood | Yes | 68 | 41 | 0.00015 | 3.25 | 1.7 6.2 |
| | | No | 28 | 55 | | | |
| 10 | Density of human population in area | High | 68 | 38 | 0.00001 | 4.2 | 2.1 8.37 |
| | | Low | 28 | 60 | | | |
| 11 | History of skin/genital diseases | Yes | 58 | 26 | 0.00001 | 4.2 | 2.1 8.37 |
| | | No | 38 | 70 | | | |
| 12 | Type of breeding dog | Common | 69 | 30 | 0.0000013 | 5.4 | 2.6 11.08 |
| | | Own | 27 | 66 | | | |
| 13 | No of dogs per house | < 2 Dogs | 58 | 36 | 0.0011 | 2.83 | 1.46 5.47 |
| | | > 2 Dogs | 39 | 60 | | | |
| 14 | Stray dog population in the area | Yes | 71 | 49 | 0.0009 | 3.01 | 1.51 5.93 |
| | | No | 25 | 47 | | | |
| 15 | Red discharge as sole indicator of heat | Yes | 66 | 51 | 0.03 | 2.05 | 1.076 3.71 |
| | | No | 30 | 45 | | | |

Map depicts that cases were most frequent in some towns of Lahore district *i.e.* cantonment= 22, Gulberg town = 18, Aziz Bhatti Town = 16, and Iqbal Town =14. While the low number of cases were recorded in other towns (Shalamar Town=0, Wagha Town=2, Nishtar Town=4, Ravi Town=6, Data Ganj Bakhsh Town=6, SamanAbad Town=8). A monthly trend over the whole year was also assessed which depicted the more reported cases during winter season (Fig. 5).

Univariate analysis revealed 12 significant variables (Table I) that were further included in CATPCA. For categorical PCA, cases were analyzed with the controls in the same parameters. In the initial steps, all the 12 components calculated were screened based on eigenvalue more than 1 as a general selection rule. Remaining 3 selected components were accounting for 73.2% of variance with 81.7% Cronbach's alpha criterion (Fig. 6). These components such as dogs in neighborhood, density

of human population in area and stray dog population in the area demonstrated their important involvement in the occurrence and spread of this disease by being correlated with disease status of dogs. The biplots of these components and objects revealed their association with the occurrence of CTVT in positive cases.

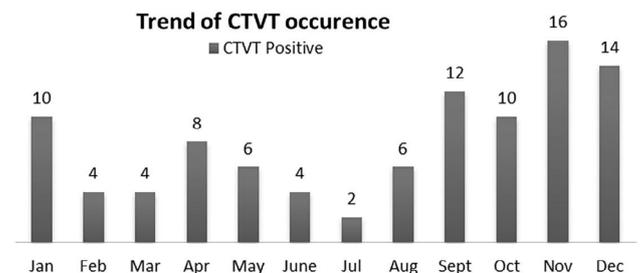


Fig. 5. Trend of positive cases received around the year.

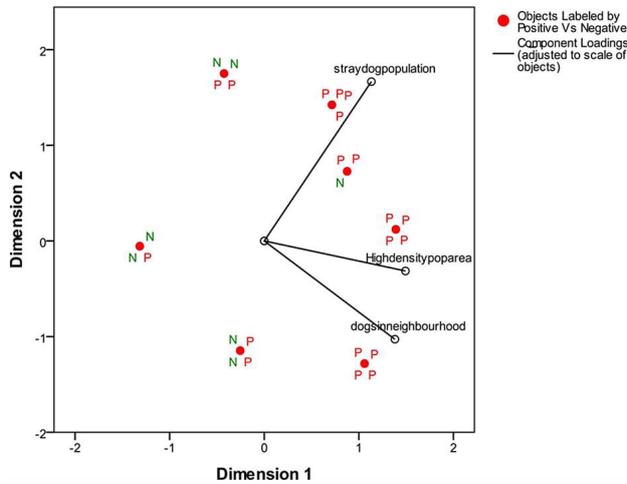


Fig. 6. CATPCA and biplots among 3 selected variables from univariate analysis.

DISCUSSION

Current study implicates that there is no significant difference between genders, different age groups and different breeds either imported or mongrels that can influence the disease burden. These results are similar to previous studies (Batamuzi *et al.*, 1992; Kabuusu *et al.*, 2010). The possible cause of variable frequency among the groups is might be due to their key importance in dog breeding business and notion of obtaining higher sperms and ova quality (Ortega-Pacheco *et al.*, 2003; Rogers *et al.*, 1998).

Various breed dogs are mostly found in the urban areas and more case presentations are found in these regions. High number of diagnosed CTVT cases may be due to more caring behavior in these areas towards pets as compared to other areas. This study only provides little observation of temporal and spatial trends of CTVT in Lahore and does not provide statistically significant results on this matter.

Categorical principal component analysis depicts that a significant portion of CTVT cases are located mainly around the variables such as stray dog. That is, dogs with CTVT, in general, had higher scores for the stray dog populations, which showed a trend to increase occurrence rate of CTVT. Furthermore, dogs in neighborhood and high density population area also increased the occurrence of CTVT.

CONCLUSIONS

The basic objective of the study was to identify the distribution and trends associated with CTVT among

owned dogs in Pakistan. This study has identified some trends and circumstances regarding the CTVT. Guidelines and policies focusing the control could reduce the risk of CTVT infection in owned dogs in Pakistan and in other developing countries of tropics. Good management practices and strict biosecurity together can prevent the unchecked introduction of infected dogs. There should also be improvement in breeding practices and management.

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Statement of conflict of interest

The authors declare that they have no conflict of interest

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