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Research Article

Estimation of blood gas parameters in Brachycephalic breeds

S.Hamsa Yamini^{1*}, S.Kavitha², A.P.Nambi³ and D.Sumathi⁴

¹ Ph.D., Scholar, Department of Veterinary Clinical Medicine,

² Associate Professor, Department of Clinical Medicine,

³ Professor, Department of Clinical Medicine,

⁴ Assistant Professor, Department of Clinical Medicine,
Madras Veterinary College, TANUVAS, Chennai-07.

*Corresponding Author

Abstract

Keywords

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Canine brachycephalic airway syndrome (BAS), also known as brachycephalic syndrome, has been reported in many brachycephalic breeds like shih tzu, pug, English bull dogs etc. BAS is commonly encountered in small animal practice owing to the increasing popularity of breeds affected. It comprises primary anatomic components and many secondary sequelae. It is an emergency condition which requires prompt therapy. Blood gas analysis plays a major role in the assessment and response to treatment in these dogs. The present study, Estimation of Blood Gas Parameters in Brachycephalic Breeds was carried out with the objectives of to estimate the various blood gas parameters in brachycephalic breeds and find the incidence of brachycephalic airway obstruction syndrome. The incidence of brachycephalic airway syndrome among the brachycephalic dogs selected for the study was 27.27 per cent. The common breeds recorded in the study were pugs and boxer. A non-significant increase in PaCO₂ and a significant decrease in PaO₂ was recorded in apparently normal brachycephalic dogs when compared to dolichocephalic and mesocephalic dogs. Dogs presented with brachycephalic airway syndrome had respiratory acidosis.

Introduction

Brachycephaly refers to canine breeds with “severe shortening of the muzzle, and therefore the underlying bones, and a more modest shortening and widening of the skull”. Conformational anomalies in brachycephalic dogs (BD) often are referred to as the brachycephalic syndrome (BS). The BS is characterized by increased upper airway resistance because of narrowed nostrils, an elongated and thickened soft palate, everted laryngeal sacculles, and a hypoplastic trachea. Prominent nasopharyngeal turbinates have also been reported. Studies have demonstrated laryngeal and pharyngeal dysfunction in BD. However, little is known about the consequences of upper airway obstruction on the physiology of lower airways and lung parenchyma. BAS is commonly encountered in small animal practice owing to the increasing popularity of breeds affected. It comprises primary anatomic components and many secondary sequelae. It is an emergency condition which requires prompt therapy. Blood gas analysis plays a major role in the assessment and response to treatment in these dogs.

Standardization of these parameters helps in better assessment and management of these dogs. With an increase in incidence of BAS in small animal practice the current project work was taken up with the following objectives: To estimate the various blood gas parameters in brachycephalic breeds and to report the Incidence of brachycephalic airway obstruction syndrome.

Materials and Methods

The study was carried out at the Critical Care Unit Department of Veterinary Clinical Medicine, Ethics and Jurisprudence, Madras Veterinary College, Tamil Nadu Veterinary and Animal Sciences University, Chennai – 600 007 by utilizing the clinical cases presented to the Critical Care Unit of the Madras Veterinary College Teaching Hospital. The study consisted of apparently healthy animals

and clinical cases. Ten apparently healthy dolichocephalic and mesocephalic dogs brought for routine check up and vaccination were randomly selected to collect reference values of the parameters under study (Group I). During the study period, 22 brachycephalic dogs were selected for the study. 16 dogs were apparently healthy brachycephalic dogs (Group II) , while 6 dogs were dogs presented with brachycephalic airway obstructive syndrome (Group III).The pH, PaCO₂, PaO₂ and hematocrit were studied in all these dogs. An automated blood gas analyser (SIEMENS OL085-RAPIDLAB 348) was used to assess the blood gas parameters like pH, PaO₂, PaCO₂ and hematocrit as per recommended protocols of [5]. Dogs presented with respiratory distress were medically managed. Medical management associated with brachycephalic syndrome was aimed at decreasing airway turbulence and the resulting inflammation and edema. These dogs were sedated with either butorphanol at the dose rate of 0.2 mg/kg to 0.4 mg/kg intramuscularly or diazepam 0.2mg/kg intravenously. Short acting anti-inflammatory glucocorticoid at the dose rate of 0.2mg/kg intramuscularly was administered[3] . The data obtained in the study were subjected to statistical analysis using SPSS 20.0 as described by [7]and were discussed.

Results and Discussion

During the study period, Out of 22 brachycephalic dogs selected for the study, 16 (72.72 per cent) dogs were apparently brachycephalic dogs. The remaining six (27.27 per cent) were presented with brachycephalic airway syndrome.

The common breeds recorded in the study was Pugs and Boxer. Group II, included 4 Boxer and 12 Pugs while Group III included five Pug and one Boxer. The reported the

common breeds with brachycephalic airway obstructive syndrome include pug, perkingese, boston terriers, English bull dogs and boxers [8] . Since the population of Pug and Boxer are high in Chennai, the incidence in these were recorded.

The mean ±SD of pH in dogs under Group I, Group II and Group III are 7.44±0.005, 7.41±0.009 and 7.29±0.033 respectively (Table 1) . A significant difference was recorded in dogs under Group III when compared with control dogs which suggested that respiratory acidosis was observed in Group III as suggested by suggested[2].

The mean ±SD of PaCO₂ in dogs under Group I, Group II and Group III are 33.65±1.31, 38.51±2.01, and 56.67±2.60 respectively (Table 1) . A significant increase in PaCO₂ was recorded in dogs under Group III when compared with Group I and Group II dogs. The dogs with airway obstruction like brachycephalic syndrome have an increase in PaCO₂ due to obstruction in the airway resulting in accumulation on carbon di oxide in the system which concurred in our study [6].

As suggested [1] arterial blood gas analysis in brachycephalic breeds have shown higher PaCO₂ than mesocephalic or dolichocephalic dogs, in our study a non-significant increase in PaCO₂ was recoded in apparently normal brachycephalic breeds when compared to the normal mesocephalic or dolichocephalic dogs.

The mean ± SD of PaO₂ in dogs under Group I, Group II and Group III are 90.93±1.81, 70.35±2.759 and 53.13±3.17 respectively (Table 1). A significant decrease in PaO₂ was recorded in dogs in Group II and Group III when compared with normal dogs.

Table 1: Blood gas parameters of dogs under various groups

parameters	Group I(n=10)	Group II(n=16)	Group III (n=6)	Significance
pH	7.44±0.005 ^b	7.41±0.009 ^b	7.29±0.033 ^a	21.203**
PaCO ₂	33.65±1.31 ^a	38.51±2.01 ^a	56.67±2.60 ^b	22.982**
PaO ₂	90.93±1.81 ^a	70.35±2.759 ^b	53.13±3.17 ^c	33.93**
Haematocrit	43.71±1.98	45.43±2.01	48.33±3.85	0.655 ^{NS}

**- P<0.01, highly significant

NS- non-significant

Superscripts bearing same alphabets do not differ significantly

As suggested [1] arterial blood gas analysis in brachycephalic breeds have shown lower PaO₂ than mesocephalic or dolichocephalic dogs, in our study a significant decrease in PaCO₂ was recoded in apparently normal brachycephalic breeds when compared to the normal mesocephalic or dolichocephalic dogs.

Owing to the anatomic differences, brachycephalic dogs have an increased resistance to airflow and an increased intraluminal pressure gradient during inspiration. The decrease in the size of the opening of the nares, nasal passage way and larynx by half would increase the airway resistance in brachycephalic breed 16 times that of non-brachycephalic breed[4]. The increased negative pressure

created to overcome the resistance causes soft tissue to become inflamed, tonsil and laryngeal saccules to evert, and larynx and trachea to collapse. A vicious cycle of increased airway resistance that leads to oedema and swelling and worsening resistance is often responsible for acute respiratory distress and hypoxemia. Similarly in our study, a significant decrease in PaO₂ was recorded in dogs presented with respiratory distress.

The mean \pm SD of Haematocrit in dogs under Group I, Group II and Group III are 43.71 \pm 1.98, 45.43 \pm 2.01 and 48.33 \pm 3.85 respectively (Table 1) . The dogs under Group II and Group III had a slight increase in the PCV value as suggested [1] who further reported that this might be due to a compensatory mechanism to maintain normal arterial content of oxygen and chronic hypoxia is a strong stimulus for red cell production.

Conclusion

Brachycephalic airway obstruction syndrome is a common complaint in brachycephalic breeds. It is an emergency condition which requires prompt therapy. Assessment of these dogs requires blood gas analysis. So standardization of these parameters helps in better assessment and management of these dogs.

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