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Systolic blood pressure measurements with Doppler ultrasonic flow detector and high-definition oscillometry are comparable on population level but show large intra-individual differences in apparently healthy elderly dogs

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OBJECTIVE
Agreement of systolic blood pressure measurements (SBP) between noninvasive blood pressure devices in conscious dogs is poorly studied. Situational hypertension is expected in clinics, but studies are lacking. This study aimed to compare SBP measurements obtained with Doppler ultrasonic flow detector (Doppler) versus high-definition oscillometry (HDO) in clinics and at home and to estimate the prevalence of situational hypertension in conscious, apparently healthy elderly dogs.

ANIMALS
122 apparently healthy elderly or geriatric dogs were prospectively recruited.

PROCEDURES
Systolic blood pressure was obtained consecutively with Doppler and HDO techniques in a randomized order per dog, following a standardized protocol. An at-home measurement was advised for in-clinic hypertensive dogs (SBP ≥ 160 mmHg), also using both devices.

RESULTS
Dual measurements were available in 102 dogs. Median SBP was 147.3 mmHg (range, 105 to 239 mmHg) for Doppler and 152.3 mmHg (range, 113 to 221 mmHg) for HDO. Forty-six percent (56/122) were hypertensive, of which 9% (11/122) were hypertensive with both methods. No significant difference was found between the 2 devices in the global study population or within the group of hypertensive dogs. Repeated at-home measurements were performed in 20/56 (35.7%) hypertensive dogs, resulting in a 10 and 26 mmHg lower median SBP value for Doppler and HDO, respectively ($P > .05$). In-clinic situational hypertension was presumed in 8/20 (40%) dogs.

CLINICAL RELEVANCE
The choice of the noninvasive blood pressure device did not significantly impact SBP results, but large interindividual differences in SBP between techniques occurred. Situational hypertension was frequently observed in clinic.

Blood pressure (BP) measurement is considered essential in dogs suffering from diseases associated with systemic hypertension and is recommended as part of health screening in senior and geriatric dogs.[1–7] Measurement of direct BP, the gold standard in dogs, is often not applicable in practice, due to the need for sedation/anesthesia and high degree of technical skills required.[8,9] Noninvasive BP (NIBP) measurement devices are easy to use and routinely available. The most commonly used NIBP measurement techniques in practice and research settings are Doppler ultrasonic flow detector (Doppler) and oscillometry and more recently high-definition oscillometry (HDO).[10,11] However, validation data of these techniques in conscious dogs are scarce.[8,12,13] Current guidelines for BP monitoring and management of hypertension are applicable for all devices, so it is important to know whether the type of device might influence SBP results.[12,13]

Hypertension is frequently observed in conscious, apparently healthy elderly dogs, with a prevalence up to 53% (53/100) reported in a recent health screening study.[6,14] In people, age-related increase in systolic BP (SBP) is well described,[15,16] but conflicting results have been found in aging dogs.[17,18] Situational (previously known as "white coat") hypertension has been suggested as a hypothesis for the high prevalence of increased BP in elderly dogs in clinic situations, despite appropriate acclimatization.[6,14] Situational hypertension in aged (≥ 70 years old) human populations has been described to be as high as 48%.[19] Out of office (both ambulatory and home) BP monitoring is therefore recommended worldwide for identification of true hypertension in these human patients.[20] Similarly, in nervous or stressed dogs, BP may be lower at home.[21,22] A small number of veterinary studies comparing in-clinic versus at-home SBP measurements reveal conflicting results.[22,23] However, results may vary because of overall small study sample size and differences in study design, including BP measurement method used.[22–24] Besides age, environment, and method, other factors that can influence SBP measurements are operator experience, breed, sex, dog's temperament, and owner's presence.[8,9]

The main aim of this prospective study was to compare SBP measurements obtained with Doppler versus HDO in conscious, apparently healthy elderly dogs. A secondary aim was to assess the impact of situational hypertension in the in-clinic hypertensive dogs by repeating measurements in the dog's home environment. The high prevalence of hypertension in elderly healthy control dogs makes them of interest to compare whether results from the 2 devices are comparable in detecting hypertension as well as to evaluate prevalence of situational hypertension.

Materials and Methods

Study population

Apparently healthy senior dogs, as defined by a previously published Age Analogy Chart,[25] were prospectively recruited for a complete health screening as part of another study. Dogs had to be "healthy for the owner", meaning that, in the owner's opinion, the dog did not have any problem necessitating veterinary care. Dogs needed to be free of medication for at least 2 months before inclusion. Preventive medication (eg, deworming, vaccination, etc) was allowed until 2 weeks before inclusion. For purebred dogs, a maximum of 10 dogs of the same breed were allowed to enter the study to avoid bias of the study results by breed effect. The study was completed at the Ghent University Small Animal Clinic between July 2019 and April 2021. All dogs were privately owned, the owners signed an informed consent, and the study was approved by the local and national ethical committees (EC 2019/39).

Comparison of 2 NIBP devices

The 2 NIBP measurement techniques, with the use of Doppler (Vetdoppler; Alcyon Belux) and HDO (VetHDO; S+B medVET GmBH), were performed consecutively prior to the health screening procedures (physical examination, blood sampling, cystocentesis, and fundoscopy). Randomization to determine whether Doppler or HDO was used first was obtained for each dog by use of an online tool.[26] Measurements were realized according to the American College of Veterinary Internal Medicine (ACVIM) guidelines by the same experienced individual (SM) and following a standardized protocol.[8] Dogs were allowed to acclimatize for 5 to 10 minutes in the consultation room, and measurements were preferentially performed in the owner's presence. For each dog, 3 to 5 measurements were obtained with each technique and the mean SBP value was calculated. Doppler and HDO measurements were preferably done at the front leg and tail base, respectively, but this could be adjusted on the basis of the dog's preference (ie, the least stressful measurement). Cuff width was chosen such that it corresponded to 30% to 40% of the circumference of the cuff site. Measures were taken to limit the vertical distance from the heart base to the cuff. If a > 10-cm level difference was noted, a correction factor was applied according to the ACVIM guidelines.[8] Position of the dog (eg, standing, sitting, or lateral or sternal recumbency) and site of measurements (eg, left of right front leg or hind leg or tail base) were recorded. For the HDO technique, graphic software was used to identify and exclude unreliable measurements. Stress level was subjectively scored for each dog by the same individual (SM) using the clinic dog stress scale (CDSS) system (0 = solicitous of attention; 1 = calm, relaxed, seemingly unmoved; 2 = alert but calm and cooperative; 3 = tensed but cooperative, not very relaxed; 4 = very tensed, not cooperative, shaking, would not sit/lie down; and 5 = extremely stressed, barking, trying to hide, and needing to be lifted up).[27] Indirect fundoscopy was performed in all dogs to detect ocular target lesions secondary to hypertension, such as retinal hemorrhage or detachment, subretinal edema, or tortuous vessels.[28,29] Dogs were considered hypertensive when SBP ≥ 160 mmHg was measured with either method.[8] Body and muscle condition were scored applying the World Small Animal Veterinary Association scoring system, using the 9-point and 4-point scales, respectively.[30] At the end of the physical examination, 10 mL of blood was taken from the jugular vein and 5 to 10 mL of urine was collected by ultrasound-guided cystocentesis or free catch. Hematology (Procyte Dx; IDEXX Laboratories Inc), serum biochemical profile (Catalyst Dx; IDEXX Laboratories Inc) including concentrations of electrolytes (sodium, potassium, calcium, and phosphate), and symmetric dimethylarginine (EIA test; IDEXX BioAnalytics) were performed. Urinalysis consisted of measurement of urine specific gravity with a manual refractometer; urinary pH; urinary dipstick (CHEM velocity stick; Beckman Coulter); sediment evaluation; urinary protein:creatinine ratio (UPC; protein, color test and creatinine, kinetic test; Beckman Coulter); and bacterial culture (aerobic culture; IDEXX BioAnalytics). Specific attention was paid to clinical and/or laboratory indications for the presence of chronic kidney disease, Cushing disease, diabetes mellitus, or pheochromocytoma.

Impact of situational hypertension in hypertensive dogs

For dogs with in-clinic hypertension, a remeasurement at home was advised to the owners, again using both NIBP methods (Doppler and HDO) in a randomized order and performed using the same methodology by the same individual (SM). A new randomization order was obtained for at-home measurements.[26] The same CDSS scores were applied by the same individual (SM) during the at-home measurement.

Statistical analysis

All statistical analyses were performed with the statistical software package SPSS (SPSS Statistics version 28; IBM Corp). Normality was tested with the Kolmogorov-Smirnov test. To compare results from the 2 NIBP devices, differences in median SBP were analyzed by a nonparametric Wilcoxon rank sum test and graphically assessed by obtaining a frequency distribution figure. A Bland-Altman plot was constructed to more thoroughly evaluate the agreement between both NIBP devices.[31] To evaluate the effect of time and/or stress on SBP measurements, despite the randomization performed, the difference between measurements 1 and 2, regardless of the measurement method, was similarly assessed through a Wilcoxon rank sum test. A Spearman ρ coefficient was calculated to assess the relationship between SBP and subjective stress level. The level of significance was set at 5%.

Results

Study population

In total, 122 dogs were recruited. Median age was 9 years (range, 5 to 15 years), and median body weight was 16.5 kg (range, 1.2 to 73.8 kg). The study population comprised 14 mixed-breed dogs, 10 Border Collies, 8 Golden Retrievers, 9 Belgian Shepherds, 6 Labrador Retrievers, 6 Chihuahuas, 6 Dachshunds, 5 Shetland Sheepdogs, 5 Jack Russel Terriers, 4 Shih Tzus, 4 English Cocker Spaniels, 4 Rottweilers, 4 Cavalier King Charles Spaniels, and ≤ 3 dogs each of 29 other breeds.

In 1 dog, SBP could not be obtained prior to health screening with either device due to severe stress (CDSS score, 5), but SBP was measurable at the end of the consultation (Doppler, 177 mmHg; HDO, 121 mmHg). In 19 dogs, SBP could only be obtained with 1 NIBP device (Doppler, n = 16; HDO, 3). The main reason for not obtaining a measurement was a technical artifact (tail wagging, poor contact, obtaining graphically unreliable measurements, blunted tail, or not willing to lie down). The median CDSS score was 2 (range, 1 to 4) for these 19 dogs. Doppler SBP was measured in a standing (n = 43), lying (33), or sitting (42) position, on the left (62) or right (56) radial artery. In 104 dogs, HDO SBP was measured at the coccygeal artery, in a standing (n = 78), lying (19), or sitting (7) position. In the remaining dog, HDO SBP was measured at the left radial artery in a sitting position. In none of the dogs did the vertical distance between the heart base and cuff exceed 10 cm.

Data of SBP measurements were not normally distributed. Median SBP was 147 mmHg (range, 105 to 239 mmHg; n = 118) for Doppler and 152 mmHg (range, 113 to 221 mmHg; 105) for HDO. In total, an SBP ≥ 160 mmHg was measured in 56 of 122 (45.9%) dogs. Of these 56 dogs, 31 were hypertensive with Doppler (median, 174 mmHg; range, 161 to 239 mmHg; 11 measurements ≥ 180 mmHg) and 36 were hypertensive with HDO (median, 171 mmHg; range, 161 to 221 mmHg; 10 measurements ≥ 180 mmHg). Eleven were hypertensive with both methods (median, 170 mmHg; range, 162 to 220 mmHg; none had SBP ≥ 180 mmHg with both methods). None of the hypertensive dogs had a renal azotemia (defined as a serum creatinine level > 159 µmol/L; 1.8 mg/dL or serum symmetric dimethylarginine > 16 µg/dL with inadequately concentrated urine [urine specific gravity < 1.030]). Seven of the 56 (12.5%) in-clinic hypertensive dogs showed persistent renal proteinuria (UPC ≥ 0.5 not explained by urinary sediment on 3 consecutive urine samples), compared to 1 of the 66 (1.5%) normotensive dogs. One of the hypertensive dogs with persistent renal proteinuria, was also diagnosed with an anal sac adenocarcinoma stage 3. If a cutoff of ≥ 0.2 was considered for UPC, 4 additional hypertensive dogs (11/56 [19.6%]) had a persistently abnormal UPC, compared to 7 additional normotensive dogs (8/66 [12%]). One hypertensive dog had a phosphate level above the reference interval (2.33 mmol/L; upper reference limit, < 2.2 mmol/L), while 7 showed hypophosphatemia (0.42 to 0.79 mmol/L; lower reference limit, > 0.8 mmol/L). Fourteen of the 56 (25%) in-clinic hypertensive dogs were overweight or obese (body condition score ≥ 6/9; median, 6; range, 6 to 8), compared to 11 (16.6%) of the 66 normotensive dogs (median body condition score, 6; range, 6 to 8). In the remaining dogs, no other diseases frequently associated with systemic hypertension (such as diabetes mellitus or Cushing disease) were detected/suspected on the basis of physical examination, blood examination, and urinalysis. None of the hypertensive dogs showed hyperkalemia. None of the in-clinic hypertensive dogs had evidence of hypertensive retinopathy.

Comparison of 2 NIBP devices

Dual in-clinic measurements were available for 102 dogs. Median SBP was 147 mmHg (range, 105 to 239 mmHg) for Doppler and 152 mmHg (range, 113 to 221 mmHg) for HDO. Doppler was the first measurement technique in 61 dogs, and in the remaining 61 dogs this was HDO. The median measurement difference between Doppler and HDO was 11.8 mmHg (range, 0 to 112 mmHg). Compared to Doppler, HDO gave higher values in 52 dogs and lower values in 49 dogs **(Figures 1 and 2)**. Within the group of hypertensive dogs (n = 56), the median measurement difference was 29.6 mmHg (range, 1.4 to 113 mmHg). No significant difference was found between the 2 devices using a Wilcoxon rank sum test in the global study population (*P* = .145) or within the group of

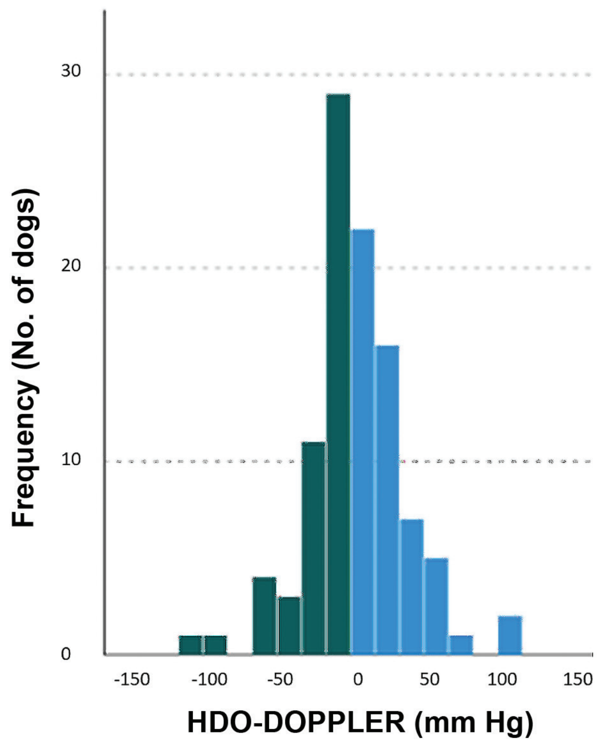

Figure 1—Frequency distribution of the differences in paired mean systolic blood pressure (SBP) measurements obtained in clinic with high-definition oscillometry (HDO) versus Doppler ultrasonic flow detector (Doppler) for 102 of 122 apparently healthy, older (median age, 9 years; range, 5 to 15 years) client-owned dogs evaluated between July 1, 2019, and April 26, 2021, with a mean for each method calculated from 3 to 5 measurements/dog. Dual measurements were not available for the remaining 20 dogs. Green bars represent dogs with higher mean Doppler measurement (n = 49); blue bars represent dogs with higher mean HDO measurements (52).

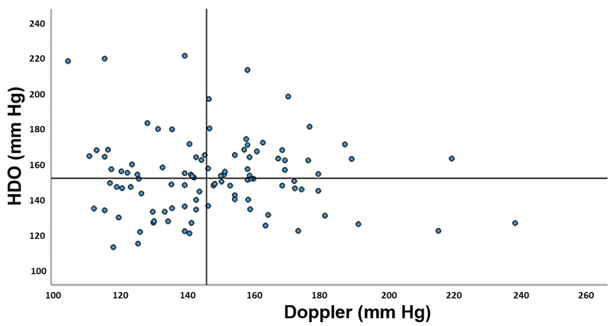

Figure 2—Scatter plot of the paired mean SBP measurements for 102 dogs with dual measurements described in Figure 1, with each circle representing the paired mean HDO and mean Doppler measurements for 1 dog. The overall median SBP measurements obtained with the HDO and Doppler are indicated by the horizontal and vertical lines, respectively.

hypertensive dogs (*P* = .255). Also, no significant difference was observed in SBP between the first and second measurement (*P* = .848) in the global study population. The Bland-Altman plot provided a visualization of how well both devices agreed **(Figure 3)**.

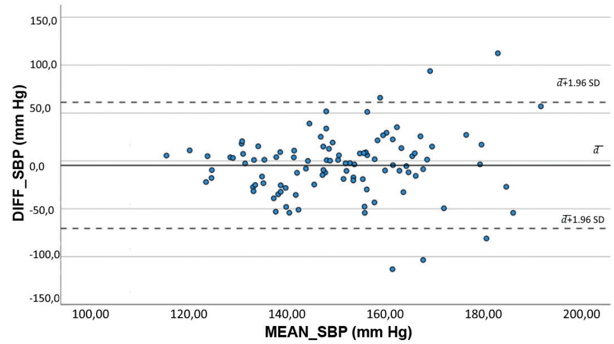

Figure 3—Bland-Altman plot of the paired mean SBP measurements for 102 dogs with dual measurements described in Figure 1. The absolute differences between all paired measurements (DIFF_SBP, on the Y-axis) are plotted against the means of all paired measurements (MEAN_SBP, on the X-axis). The solid black horizontal line represents the mean difference ($\bar{d}$) and shows that the average difference in SBP between both devices is –4.63 mmHg. The dashed horizontal lines describe the 95% limits of agreement and are computed as the mean difference ± 1.96 X SD of the differences. This range (–70.45 to 61.19 mmHg) covers 95% of all differences between the 2 noninvasive BP devices.

The mean ± SD difference between measurements for the 2 devices was –4.63 ± 33.58 mmHg. The 95% limits of agreement were –70.45 and 61.19 mmHg, meaning that SBP measured through Doppler ranged between 70.45 mmHg less and 61.19 mmHg more compared to HDO (and vice versa). Visual inspection of the plot revealed that the difference between the 2 devices was lower at low normal SBP values.

A moderate positive relationship (ρ = 0.536; *P* < .01) between CDSS score and Doppler measurement in clinic was present **(Figure 4)**. However, no significant relationship could be detected between CDSS score and HDO measurement in clinic (ρ = 0.03; *P* > .05).

Impact of situational hypertension in hypertensive dogs

At-home repeated measurement was performed in 20 of the 56 (35.7%) in-clinic hypertensive dogs. Unfortunately, repeated measurements at home were not possible in the other 36 dogs due to COVID-related restrictions. In 3 and 4 dogs, in-clinic values were missing for Doppler and HDO, respectively. In 4 of 20 dogs, SBP at home could only be obtained with 1 device (Doppler, n = 3; HDO, 1). Median at-home SBP with Doppler was 166 mmHg (range, 115 to 202 mmHg), compared to 176 mmHg (range, 146 to 220 mmHg) in clinic. For Doppler, 6, 1, and 9 dogs had an SBP value respectively higher, equal to, and lower, respectively, at home than in clinic. A Doppler SBP ≥ 160 and ≥ 180 mmHg was observed in 5 and 1 at home, respectively, compared to 15 and 6 dogs in clinic. Median at-home SBP with HDO was 137 mmHg (range, 116 to 185 mmHg), compared to 163 mmHg (range, 122 to 213 mmHg) in clinic. For HDO, SBP was higher in 5 dogs and lower in 8 dogs at home than in clinic. An HDO SBP ≥ 160 mmHg was observed in 1 dog at home, compared to 3 dogs

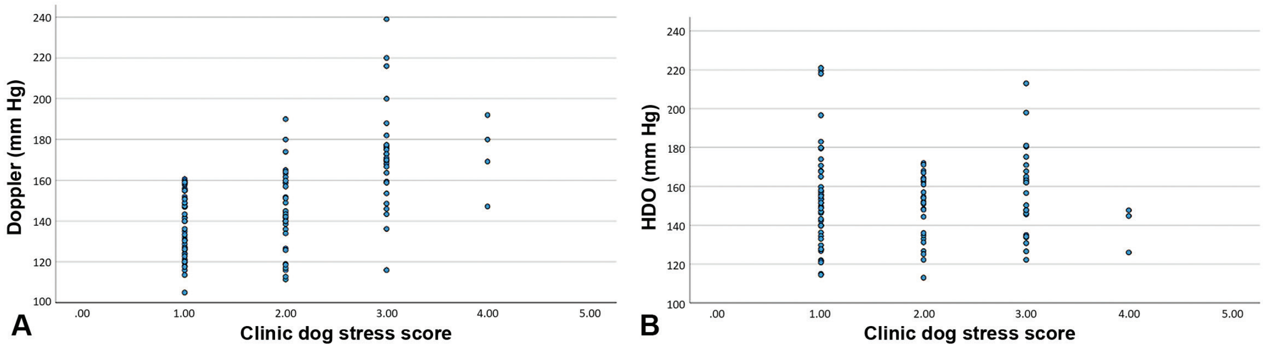

Figure 4—Individual value plots of the mean in-clinic SBP measurements obtained with the Doppler (A) or HDO (B) method (calculated from 3 to 5 measurements/dog for each method) for 122 dogs described in Figure 1 grouped by clinic dog stress scale score[27] (on a scale from 0 [solicitous of attention] to 5 [extremely stressed, barking, trying to hide, and needing to be lifted up]). Each circle represents the results for 1 dog. For the dogs with nonmeasurable SBP, the stress scores are not shown graphically.

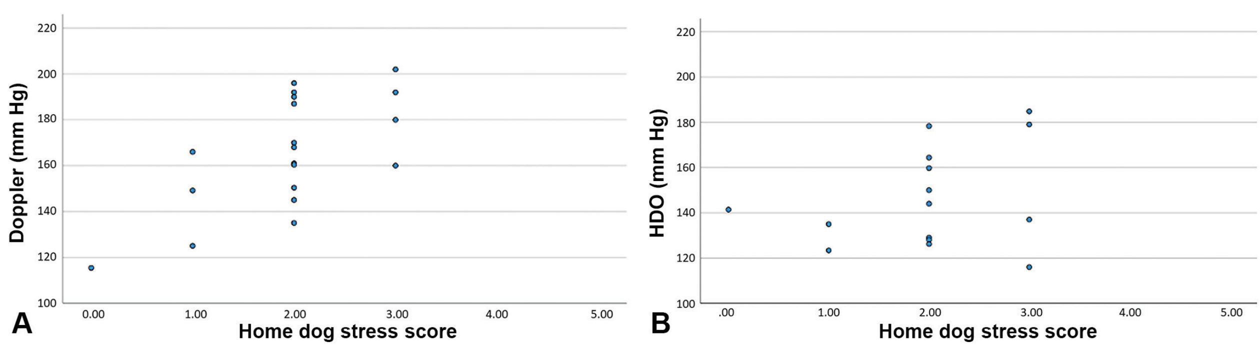

Figure 5—Individual value plots of the mean at-home SBP measurements obtained with the Doppler (A) or HDO (B) method (calculated from 3 to 5 measurements/dog for each method) for the 20 dogs described in Figure 4 that had hypertensive measurements in clinic, grouped by home dog stress score (on a scale from 0 [solicitous of attention] to 5 [extremely stressed, barking, trying to hide, and needing to be lifted up]). Each circle represents the results for 1 dog.

in clinic. The median SBP values were 10 and 25.9 mmHg lower at home, compared to in clinic, when measured with the use of Doppler and HDO, respectively. Blood pressure values, however, were not statistically different for either device at home versus in clinic ($P > .05$). Over half of the dogs (12/20 [60%]) still showed hypertension at home, but SBP normalized in 8 of 20 (40%). The median CDSS score at home was 2 (range, 0 to 3), compared to 3 (range, 2 to 5) in clinic. Overall, a significant lower CDSS score was noted during at-home measurement compared to in-clinic measurement ($P < .01$). Similar to the in-clinic findings, a moderate positive relationship was found between CDSS score and Doppler ($\rho = 0.568$; $P < .05$) but not for HDO ($\rho = 0.26$; $P = .33$; **Figure 5**).

Discussion

The main aim of this study was to compare SBP values obtained by HDO and Doppler. Results showed that (1) the choice of NIBP device did not significantly affect SBP values in this population of apparently healthy elderly dogs; (2) by performing at-home measurements, situational hypertension could be identified in 40% (8/20) of in-clinic hypertensive dogs; and (3) only for Doppler, a moderate positive relationship could be shown between a subjective estimate of stress level and SBP measurement, both in clinic and at home.

In our population of aged dogs, no significant difference in SBP measurement between Doppler and HDO techniques could be detected. However, large interindividual differences were observed, both within the global study group and more pronounced within the hypertensive group. This is also shown graphically in the Bland-Altman plot (Figure 3) with obtained wide limits or agreements. The median difference between the 2 devices also increased with increasing SBP. From a clinical point of view, such difference (> 20 mmHg) is unacceptable. This finding is in line with a recent study[9] comparing 2 oscillometric devices (HDO and petMAP) in conscious dogs, although a significant difference was shown between these 2 devices. These and our findings strengthen existing guidelines to always use the same device when monitoring SBP over time in a single patient.[8] However, if SBP is not measurable with one technique or if unexpectedly high values are obtained, another technique may be opted for. Moreover, there might be a need to develop device-specific SBP reference values. Besides the measurement device, the cuff site and position of the dog can significantly impact the accuracy of SBP measurements.[8,32] All Doppler measurements in this study were obtained at the radial/median artery, compared to 99% coccygeal artery measurements for HDO. This was deliberately chosen, as these are the most commonly used sites for both devices in private practice. A previous study[12] involving a large number of SBP measurements in 12 conscious dogs showed that the oscillometric technique correlated best with direct radiotelemetry at the coccygeal artery. To the authors' knowledge, no such data is available for HDO. For Doppler technique, the metatarsal artery had the strongest correlation with direct radiotelemetry, but significant correlation was also found for the median artery.[12] The difference in site between the 2 devices could have affected our results. However, a previous study[33] in a small number (n = 6) of healthy, awake dogs could not find a significant difference between SBP measurements obtained through Doppler and HDO both at the coccygeal artery, comparable to the data of our study.

No direct SBP measurements were performed; therefore, no conclusions can be drawn on the accuracy of the SBP measurements and on which device is most reliable to measure SBP in conscious dogs.[11] In anesthetized dogs, both techniques used in our study failed to meet ACVIM validation criteria for SBP measurements.[34,35] The performance to measure mean and diastolic BP was even worse than for measurement of SBP in conscious dogs using the Doppler technique.[35,36] Large-scale validation studies on conscious dogs for the HDO technique are lacking. In 1 study of 6 conscious Beagles, HDO failed to meet validation criteria of the Association for the Advancement of Medical Instrumentation.[36,37] This is in contrast to a similar small-scale study[32] of cats, in which HDO did fulfill ACVIM criteria, being the only validated NIBP device in this species so far.

Similar to a previous health screening study,[14] a high percentage (45.9% [56/122]) of elderly dogs showed in-clinic hypertension. It was considered unlikely that all these dogs had true hypertension as there was almost no evidence of target organ damage (no clinical signs, no fundoscopic observed lesions, and a small number of dogs with persistent renal proteinuria with no obvious indications of renal dysfunction). Additionally, in the majority of hypertensive dogs of this and the previous study,[14] an underlying disease leading to hypertension was not evident from the health screening procedures. In this study, 40% (8/20) of in-clinic hypertensive dogs had a clinically normal SBP when measured at home. These findings confirmed that situational hypertension is present in elderly, healthy-appearing dogs.[6,13,14,22] Situational hypertension seems more prevalent in elderly dogs than in cats and might hamper the value of performing BP measurement at the moment of health screening.[33] On the other hand, more frequent BP measurements in healthy dogs, even at a younger age, can habituate dogs to the procedure, potentially reducing the impact of situational hypertension. In the current study, the median SBP value was lower at home compared to in clinic for both devices, but this did not reach statistical significance. Previously, a similar small-scale study[38] (n = 10 dogs) did not find any significant difference between in-clinic and at-home SBP using Doppler technique. Two recent studies[22,39] however did find significant lower SBP values for HDO technique in conscious dogs at home compared to in clinic. However, home measurements were performed by owners, which could have potentially impacted results. Operator (student vs owner) effect on SBP value was previously shown for in-clinic measurements.[9] This was not addressed in the current study due to the study design (ie, only a single operator was involved in BP measurement). In human medicine, ambulatory (assessing day- and nighttime BP during routine daily activities, over one 24-hour period) and home (measured by the patient themself on specific time points being seated, over a longer period of time) BP monitoring are considered to provide complementary information and should ideally be combined in clinical practice.[20] Unexpectedly, about one-third of the in-clinic hypertensive dogs had a higher SBP value at home for both techniques. Erroneous results seem unlikely, as all measurements were performed by the same trained person. Masked hypertension is a known human phenomenon that can occur if a calm, quiet environment at the doctor's office is less stressful than the home setting.[40] Although subjective, the CDSS scores were significantly lower at home compared to in clinic and therefore could not explain the at-home higher SBP values. A prospective study with a larger number of study patients should investigate this further.

Subjective stress level scoring was only moderately positively associated with Doppler SBP and not with HDO SBP values. Consequently, subjective interpretation of stress state does not seem like a strong tool to assess situational hypertension, especially for the HDO technique. In the unstressed dogs (CDSS ≤ 2), almost all (79/86 [92%]) had normal SBP with Doppler, whereas several of the calm-looking dogs had a high SBP (≥ 160 mmHg) with HDO (23/77 [30%]).

A limitation to the present study was that no direct SBP measurement technique (considered gold standard) was performed. Arterial BP measurement is often not applicable in practice, due to the need for sedation/anesthesia and high degree of technical skills.[12,13] Therefore, conclusions on the accuracy of obtained SBP measurement with both NIBP devices cannot be drawn. Bias on SBP values due to time lag between device measurement is possible, as SBP can change over time. This bias was however limited by directly measuring SBP with both devices one after another and by randomizing the order of device measurement for each dog on each occasion.

Remeasurement of SBP at home was only possible in a small subset of in-clinic hypertensive dogs, which strongly weakened our conclusions regarding the frequency of situational hypertension in apparently healthy elderly dogs. COVID restrictions in Belgium at the time of the study drastically limited the possibility to perform at-home measurements in the short term.

In conclusion, the choice of NIBP device did not affect SBP measurements in this group of elderly, apparently healthy conscious dogs. Situational hypertension was a frequently observed cause of in-clinic hypertension.

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