

Effects of Blood Donation on Arterial Blood Pressure in Retired Racing Greyhounds

C. Guillermo Couto and M.C. Iazbik

The purpose of this study was to evaluate changes in systolic arterial blood pressure (SABP) immediately after collection of blood for transfusion in retired racing Greyhounds. We prospectively evaluated 19 blood donor Greyhounds before and after the collection of a unit (450 mL) of blood. The SABP was measured with Doppler in the right forearm after the dogs had been in the blood collection room for a few minutes (PRE-FLOOR) and again 5–10 minutes after the dogs were placed on the table where they would be bled (PRE-TABLE). A total of 3–5 minutes after completing the blood collection, the SABP was measured again while the dogs were still in lateral recumbency on the table (POST-TABLE) and once more 60–90 minutes later, when the dogs were on the floor after completing the donation (POST-FLOOR). All dogs were monitored for clinical signs of hypotension, including depression, weakness, collapse, and pallor, for a minimum of 2 hours after donation. There was a significant difference in SABP for the group between PRE-FLOOR and POST-TABLE ($P = .02$) and between PRE-TABLE and POST-TABLE determinations ($P = .01$). There were no significant differences for any of the other time points; there were no adverse events. Therefore, we conclude that the collection of 450 mL of blood from normal Greyhounds results in a short-lived yet significant decrease in SABP, but the likelihood of adverse events is negligible.

Key words: Dog; Hypotension; Transfusion; Vasovagal.

Blood transfusion is a relatively new area of specialization in veterinary medicine. Numerous articles have been written on the use of blood and blood components in dogs and cats, but little information is available on collection methods and their effects on donors.^{1–6}

Retired racing Greyhounds constitute ideal blood donors, because they are of an appropriate size (>25 kg); have a gentle temperament and a high hematocrit; and have large, easy-to-access jugular veins. In addition, in our experience, a high proportion of Greyhounds are DEA (dog erythrocyte antigen) 1.1-, 1.2-, and 7-negative, which thus qualifies them as universal blood donors.

Cardiovascular physiology in Greyhounds has been studied for decades,^{7–10} because several features in this breed are substantially different from those in other breeds. For example, Greyhounds have higher blood viscosity, blood pressure, cardiac output, and cardiac index than mongrel dogs, and they have larger hearts and lower peripheral resistance.^{7,8,11,12} In addition, a systolic basilar murmur due to high aortic velocity is present in >60% of Greyhounds (Fabrizio et al, unpublished data).

In a recent study of human blood donors, 36% experienced local or systemic adverse events (AEs), including bruising (22%), arm soreness (10%), fatigue (7%), vasovagal reactions (VVRs) (5%), and nausea or vomiting (1%).¹³ VVRs consist of dizziness, weakness, and pallor and develop in 2–5% of blood donors.^{14–16} Approximately 0.1–0.4% of human donors who develop VVRs experience syncopal episodes.

In our experience, weakness or syncopal episodes after blood donation are exceedingly rare in dogs. In the past 10 years, we have witnessed only 1 such event in a Greyhound after donation. In that time period, we processed approximately 700 units of canine blood.

The purpose of this study was to evaluate changes in arterial blood pressure immediately after blood donation in retired racing Greyhounds.

Materials and Methods

Nineteen retired racing Greyhounds that were enrolled in the Blood Donor Program at the Transfusion Medicine Service, Veterinary Teaching Hospital, The Ohio State University were prospectively evaluated. The dogs consisted of 9 spayed females and 10 neutered males. The females ranged in age from 4 to 9 years (median = 5.5 years) and in body weight from 27 to 39 kg (median = 29 kg). The males ranged in age from 4 to 8 years (median = 5 years) and in body weight from 30 to 41 kg (median = 34 kg). All dogs had been enrolled in the Blood Donor Program for a minimum of 4 months and had been last bled at least 5 weeks before the study date. Ten dogs weighed <33 kg (8 females and 2 males), and 9 dogs weighed >33 kg (8 males and 1 female).

Systolic arterial blood pressure (SABP) was measured with an Ultrasonic Doppler Flow detector model 811-B^a and a 4.0-cm-wide cuff. After the dogs had entered the blood collection room, the SABP was measured in the right limb, with the dogs lying in left lateral recumbency on the floor. The SABP was measured again in the same manner 5–10 minutes after the dogs were placed on the table where they would be bled.

A unit of blood (450 mL) was collected from the jugular vein in standard fashion^{3,4} by means of a quad-bag collection set with a 16-gauge needle.^b The blood was mixed with a blood rocker.^c

A total of 3–5 minutes after completing the blood collection, the SABP was measured again while the dogs were still in lateral recumbency on the table. The SABP was measured again 60–90 minutes later, when the dogs were on the floor after completing the donation. All dogs were offered a can of moist dog food at that time.^d A minimum of 3 measurements were averaged for each time point. All dogs were monitored for clinical signs of hypotension, including lethargy, weakness, collapse, and pallor, for a minimum of 2 hours after donation.

A one-way repeated-measures analysis of variance was used to compare differences in the SABP among the following: preblood collection with the dog on the floor (PRE-FLOOR), preblood collection with the

From the Department of Veterinary Clinical Sciences (Couto) and Transfusion Medicine Service, Veterinary Teaching Hospital, College of Veterinary Medicine (Couto, Iazbik), and the OSU Comprehensive Cancer Center (Couto), The Ohio State University, Columbus, OH.

Reprint requests: C. Guillermo Couto, DVM, Diplomate ACVIM, 601 Vernon L. Tharp Street, Columbus, OH 43210; e-mail: couto.1@osu.edu.

Received July 6, 2004; Revised September 29, 2004, and March 22, 2005; Accepted May 20, 2005.

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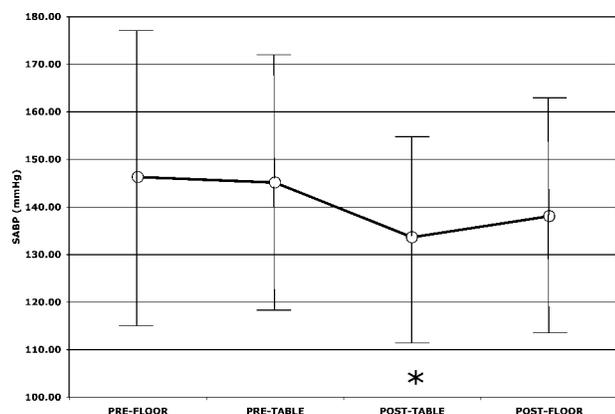


Fig 1. Changes in systolic arterial blood pressure (SABP) in Greyhounds before and after collection of 450 mL of blood for transfusion. The asterisk denotes significant difference ($P < .05$). Vertical lines denote the standard deviations.

dog on the table (PRE-TABLE), postblood collection with the dog on the table (POST-TABLE), and postblood collection with the dog on the floor (POST-FLOOR). The Bonferroni procedure was used as a post hoc test to identify which differences were significant. Differences between males and females and between dogs <33 kg and >33 kg were evaluated by a two-way repeated-measures analysis of variance and the Bonferroni procedure as a post hoc test.^c A P value $<.05$ was considered significant.

Results

Blood pressure determinations were available for 19 dogs for the following points: PRE-FLOOR, PRE-TABLE, and POST-TABLE; POST-FLOOR SABP measurements were available for only 17 dogs because of technical problems with the remaining 2 dogs.

The SABP before collection with the dog on the floor was 146 mm Hg (SD = 32 mm Hg), the SABP with the dog on the table before donation was 145 mm Hg (SD = 27 mm Hg), the SABP with the dog on the table immediately after donation was 134 mm Hg (SD = 21 mm Hg), and the SABP with the dog on the floor after donation was 138 mm Hg (SD = 25 mm Hg) (Fig 1).

A significant difference was found in the SABP for the group between PRE-FLOOR and POST-TABLE ($P = .02$) and between PRE-TABLE and POST-TABLE determinations ($P = .01$). No significant differences were found between the following: PRE-FLOOR and PRE-TABLE ($P = .8$), PRE-FLOOR and POST-FLOOR ($P = .3$), and POST-TABLE and POST-FLOOR ($P = .5$) (Table 1). No significant difference was found in the SABP between groups for

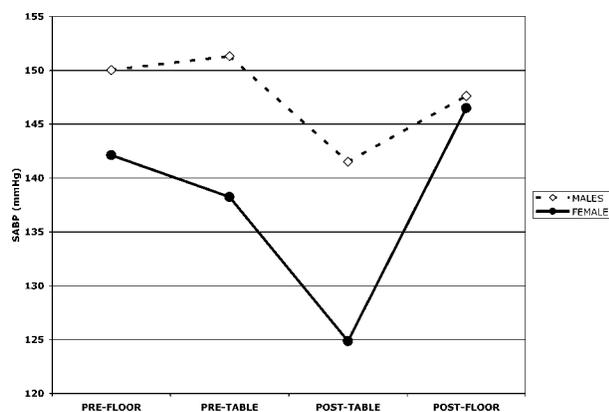


Fig 2. Changes in systolic arterial blood pressure (SABP) in male and female Greyhounds before and after collection of 450 mL of blood for transfusion.

males versus females or for dogs that weighed <33 kg versus those that weighed >33 kg (Figs 2 and 3).

Discussion

A total of 2–5% of human blood donors experience VVRs, and 0.1–0.4% of them have syncopal episodes.¹⁴ Clinical signs associated with VVRs in humans include dizziness, weakness, and pallor. Loss of consciousness, with or without tonic or clonic convulsions, constitutes a syncopal reaction. Systolic blood pressure <75 mm Hg is sufficient to cause a syncopal reaction in humans.¹⁴ To our knowledge, this information is not known for dogs.

In humans, VVRs occur as a diphasic process in which there is a transient increase in cardiac output and peripheral resistance, leading to mild hypertension. This process is followed by a sudden reduction in peripheral vascular sympathetic activity that causes peripheral vasodilatation and hypotension, and is accompanied by an increase in parasympathetic tone to the heart, with resultant bradycardia.¹⁴ The mechanisms that cause VVRs in humans are incompletely understood, but they are thought to depend on baroreceptor sensitivity, which, in turn, is influenced by age, emotional stress, and hypertension.¹⁴ The magnitude of the baroreceptor response also is related to the percentage of blood volume collected.¹⁴

This study demonstrates that the collection of 450 mL of blood for transfusion in retired racing Greyhounds is safe but that it results in a significant but transient decrease in the SABP. The standard collection volume of 450 mL rep-

Table 1. Systolic arterial blood pressure in retired racing Greyhounds (expressed in mm Hg) before and after donating 450 mL of blood for transfusion. Values expressed as means (\pm SD).*

Population	PRE-FLOOR	PRE-TABLE	POST-TABLE	POST-FLOOR
All dogs	146 (\pm 32) ^a	145 (\pm 27) ^b	134 (\pm 21) ^{a,b}	138.1 (\pm 24.7)
Males	150 (\pm 40.0)	151 (\pm 28)	142 (\pm 24)	144 (\pm 16)
Females	142 (\pm 21)	138 (\pm 25)	125 (\pm 15)	138 (\pm 25)
>33 kg	154 (\pm 41)	155 (\pm 29)	146 (\pm 23)	149 (\pm 12)
<33 kg	140 (\pm 20)	136 (\pm 23)	123 (\pm 13)	128 (\pm 29)

* Significant differences between groups as follows: ^a $P = .02$; ^b $P = .01$.

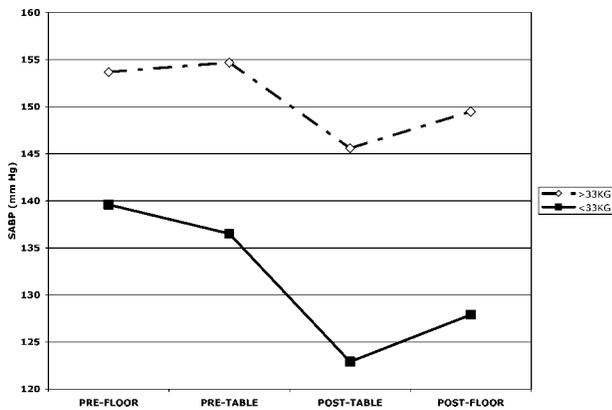


Fig 3. Changes in systolic arterial blood pressure (SABP) in Greyhounds weighing more or less than 33 kg, before and after collection of 450 mL of blood for transfusion.

resents approximately 17–22% of the total blood volume in an average-sized Greyhound. The decrease in blood pressure did not result in any appreciable adverse effects on the donors used in this study. No episodes of collapse, weakness, or lethargy occurred after blood collection in any of the dogs.

Although our model did not identify any significant effects of weight (>33 kg versus <33 kg) or sex on decreases in the SABP after blood collection, it is possible that the small number of dogs in the study did not provide sufficient statistical power. Visual inspection of the graphs (Figs 2 and 3) suggests that females and dogs <33 kg experience greater decrements in the SABP after blood collection than do males and dogs >33 kg. For example, the median SABP for the entire group before sample collection (PRE-FLOOR plus PRE-TABLE) was 146 ± 29 mm Hg (data not shown); female dogs had a mean PRE-FLOOR SABP of 150 ± 12 mm Hg and a mean POST-TABLE SABP of 126 ± 15 mm Hg (Table 1). This decrease of almost 24 mm Hg is not statistically significant, but it may be clinically relevant, particularly in smaller females.

In humans, AEs, and particularly VVRs, are twice as common in women and teenagers as in men.¹³ In a recent study of VVRs in humans, when other covariant factors such as weight, age, and 1st-time donation status were taken into account, female gender was not a significant risk factor for VVRs.^{14–16} Although not statistically significant, the SABP during the POST-FLOOR sampling period was <130 mm Hg (128 ± 29 mm Hg) in dogs <33 kg, suggesting that, in smaller dogs, the SABP takes longer to return to pre-donation values (ie, >60–90 minutes after collection) and warrants observation of the donor for a longer time period.

Although the objective of our study design was not oriented toward evaluating the prevalence of AEs after blood collection, it is likely that weakness and collapse after blood donation are uncommon in Greyhounds because postcollection SABPs rarely decrease below 100 mm Hg. In this study, only 1 dog had a postdonation SABP of <100 mm Hg (ie, 99 mm Hg). In a case-controlled multicenter study of syncopal reactions after blood donation in humans, pre-donation systolic blood pressure measurements of >150

mm Hg were protective against syncope.¹⁴ Greyhounds have higher resting blood pressure readings than do dogs of other breeds,¹¹ and this characteristic may explain the low prevalence of hypotensive complications in the breed. A prospective study comparing age-, weight-, and sex-matched non-Greyhounds with a population of Greyhounds bled under similar conditions should shed light on this topic.

Footnotes

- ^a Ultrasonic Doppler Flow detector model 811-B, Parks Medical Electronics, Inc, Aloha, OR
- ^b Sixteen-gauge needle, Baxter Healthcare Corporation, Deerfield, IL
- ^c Blood rocker, Genesis, Hackensack, NJ
- ^d Eukanuba Lamb and Rice, The Iams Company, Dayton, OH
- ^e GraphPad Prism, Graph Pad Software, San Diego, CA

Acknowledgments

Supported in part by grant P30 CA16058, National Cancer Institute, Bethesda, MD, and by the Barry French Poole Memorial Fund. The authors wish to thank Drs Tom Wittum and Ana Lara for their assistance with statistical evaluation of the data.

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