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Characteristics of Sternal Recumbency with the Legs Free in Beagle Dogs

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Abstract: During forelimb procedures, dogs resist by pulling their forehand using their body and hindlimbs. We hypothesized sternal recumbency with the legs free could easily restrain the dog since it inhibits the hind legs from being a sufficient point of effort. We aimed to compare the characteristics of sternal recumbency with the legs free and sitting position in three beagle dogs. The range of motion of the forelimb in the sitting position and sternal recumbency was 6.8 and 4.4 cm on the x-axis, respectively, while the corresponding values on the y-axis were 12.4 and 3.6 cm. There were 14 occurrences of body lifting from the table in the sitting position but none in sternal recumbency with the legs free. There were no complications observed. Sternal recumbency with the legs free reduced the range of motion without complications. Therefore, it could be a useful and safe technique for dogs undergoing specific examinations/procedures.

Keywords: dog, restraint, sitting position, sternal recumbency with the legs free

Introduction

Various diagnostic tests or examinations require dogs to be restrained in different positions[1)]. Applied restraining techniques include standing position, crowding, sitting position, sternal recumbency, lateral recumbency, and dorsal recumbency[2,3)]. The veterinary nurse should have adequate control over an animal to avoid injuries and ask for help if required[1)].

Low-stress handling is crucial for the safety of the veterinary staff and patients[4)]. Most dogs and cats exhibit fear during veterinary visits, and others may show aggression[5-6)]. Traditionally, the handling of small animals in veterinary clinics has mainly focused on the welfare of the staff rather than that of the patient[7)].

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Among veterinarians, it is widely considered acceptable to use heavy restraint or punitive measures in problematic patients to successfully perform specific examinations/procedures[7)]. However, this approach is not advisable for several reasons, including the possibility of injury to the patient and staff, increased aggression on subsequent visits, ethical obligations, and legal liability of abuse[7)].

In most muscles, activity usually involves changes in the angle of the joint(s) bridged by that muscle. Accordingly, the musculoskeletal system operates as a system of levers in which the joints act as fulcrums[8)]. The sitting position is often used in dog restraint[4)], but dogs can resist restraint by moving the forelimbs using the body and hindlimbs. Here, the forelimb is considered the point of action while the hindlimbs are considered the point of effort through various body joints. We hypothesized that sternal recumbency with the legs free (hanging under the table) could allow easy restraining of the dog since the hind legs cannot sufficiently act as a point of effort.

If the dog is successfully restrained with this restraint method, various procedures for example, blood sampling from jugular vein, placement of an indwelling needle in the forelimb, can be performed by a single holder. We expect that a stable restraint method will not only be useful in veterinary procedures, but will also provide safety for the dog and staff. This study aimed to clarify the characteristics of sternal recumbency with the legs free in beagle dogs.

Materials and Methods

This study included purpose-bred research beagle dogs (female, n = 3; mean age = 5 years [all 5 years]; mean bodyweight = 9.6 (8.6–10.5) kg. All procedures were performed in compliance with the guidelines of the Animal Research Committee of Azabu University (No. 220113-2). We compared two restraint methods: sitting position and sternal recumbency with the legs free (Fig. 1). The sitting position was selected for comparison since most procedures in veterinary treatment can be performed with the dog in the sitting position[4].

Posture of sternal recumbency with the legs free

If the dog was held to the right side, the upper body was first placed on the table. Subsequently, the dog was held between the handler's right forearm and the flank (Fig. 1); moreover, the dog's elbow was held using the handler's right hand. The handler's wrist of the hand holding the dog's forelimb was placed on the examination table while the handler's left hand held the dog's neck ventrally.

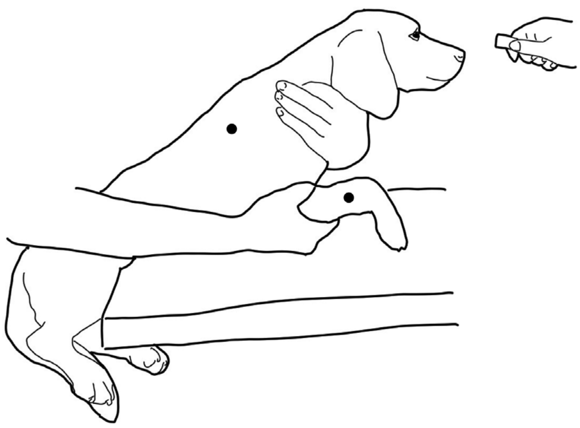

Fig. 1 The dog was held using sternal recumbency with the legs free on the examination table. A tape with a black dot was wrapped on the middle of the forelimb and shoulder. Treats (Churu, Inaba Pet Food Co. Ltd., Shizuoka, Japan) were placed in front of the restrained dog to incentivize them to move.

Procedure

To verify the usefulness of restraint, we measured movements of the forelimbs and head that should limit movement during blood sampling and placement of an indwelling needle. We estimated that the time required to hold the dog for blood sampling and placement of an indwelling needle was 1 min in clinical settings, and compared two different restraint methods of the dog for 1 min each. Before the dog was restrained, a tape with a black dot was wrapped on the middle of the right forelimb and shoulder (Fig. 1). Next, a tripod with a video camera (iPhone 11, Apple Computer, Cupertino, CA, USA) was vertically positioned against the dog's spinal axis from the right side to record the movement of a black dot on the forelimb and shoulder throughout the procedure. The camera application was set at 1080 p HD/30 fps. Subsequently, the dog was lifted from the floor, placed in the sitting position for 1 min, and returned to the floor. The dog was then lifted again from the floor, placed in sternal recumbency with the legs free for 1 min, and returned to the floor. Next, each restraint was alternatively repeated four more times. Treats (Churu, Inaba Pet Food Co., Ltd., Shizuoka, Japan) were placed in front of the restrained dog to incentivize them to move.

Photo analysis

Suitable photos were selected from the recorded video. The eye coordinate was calculated based on the normal head position in both restraints. Image analysis was performed using software (ImageJ ver. 21.03.50, National Institutes of Health, USA).

Video analysis

The setting time was calculated as the duration from the start of lifting the dog from the floor until the completion of each restraint. Regarding motion analysis of the forelimb and shoulder, the movement of a black dot on the wrapped tape was plotted using software (Vernier Video Physics ver. 3.1.2, Vernier Software & Technology, Beaverton, OR, USA). The coordinate of this black dot was calculated from the drawn point in each screenshot of the video.

Incidences of body lifting from the table were checked using the recorded videos. Specifically, we checked for the lifting of the buttocks and abdomen in the sitting position and sternal recumbency with the legs free, respectively.

Complications

The patients' abdominal skins were observed for 1 week. Other clinical complications were also checked.

Statistical analyses

Data are presented as mean ± standard deviation (SD) and were analyzed using Excel for Mac (ver. 16.61, Microsoft, Washington, USA). Regarding motion analysis of the fore-limb and shoulder, the range of motion was calculated as the difference between the maximum and minimum coordinates in both the x and y axes. The eye coordinate, setting time, and range of motions of the forelimb and shoulder (x, y) were analyzed using JMP statistical software (version 8.02; SAS Institute, Cary, North Carolina, USA). Statistical significance was set at $p < 0.05$.

Results

The eye coordinates from the normal head position in the sitting position and sternal recumbency with the legs free on the x-axis were 38.1 ± 3.4 cm and 31.7 ± 5.3 cm, respectively, while the corresponding values in the y-axis were 35.1 ± 1.6 cm, and 22.4 ± 3.0 cm (Fig. 2). Accordingly, the height (y-axis) of the eye coordinate was lower in the sternal recumbency with the legs free than in the sitting position. There was significant between-method difference in both axes (x: $p = 0.0006$, y: $p < 0.0001$).

There was a significant difference in the setting time between the sitting position and sternal recumbency with the legs free (10.8 ± 3.1 s vs. 7.1 ± 1.5 s: $p = 0.0006$).

The range of motion of the forelimb in the sitting position and sternal recumbency with the legs free on the x-axis was 6.8 ± 2.1 cm and 4.4 ± 2.9 cm, respectively, while the corresponding values on the y-axis were 12.4 ± 6.1 cm and 3.6 ± 2.2 cm (Fig. 3). The sitting position had a wider range of motion in the y axis than the sternal recumbency with the legs free since the dogs tried to stand up. There was significant between-method difference in both axes (x: $p = 0.0183$, y: $p < 0.0001$).

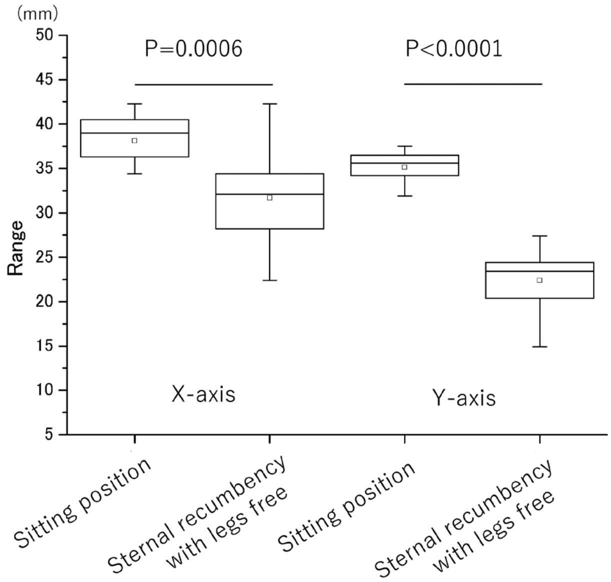

Fig. 2 The eye coordinates of the sitting position and sternal recumbency with the legs free are shown as a box plot. Box and whiskers indicate 25–75% and 5–95%, respectively. Sternal recumbency with the legs free showed significantly lower height (y axis) than the sitting position ($p < 0.0001$).

The range of motion of the shoulder in the sitting position and sternal recumbency with the legs free on the x-axis was 6.4 ± 2.6 cm and 4.2 ± 2.3 cm, while the corresponding values on the y-axis were 8.5 ± 4.7 cm and 2.2 ± 1.4 cm. There was a significant between-method difference in both axes (x: $p = 0.0241$, y: $p = 0.0001$).

Out of 15 restraining attempts in the sitting position, we observed 14 incidences of lifting the body (buttocks) from the table. In sternal recumbency with the legs free, one dog lifted the hind leg from the examination table twice while another dog lifted it once. However, there was no incidence of lifting the body (abdomen) from the table in all 15 re-straining attempts. There was a significant between-method difference in the incidence of lifting the body from the table ($p < 0.0001$). There were no complications observed, including the skin.

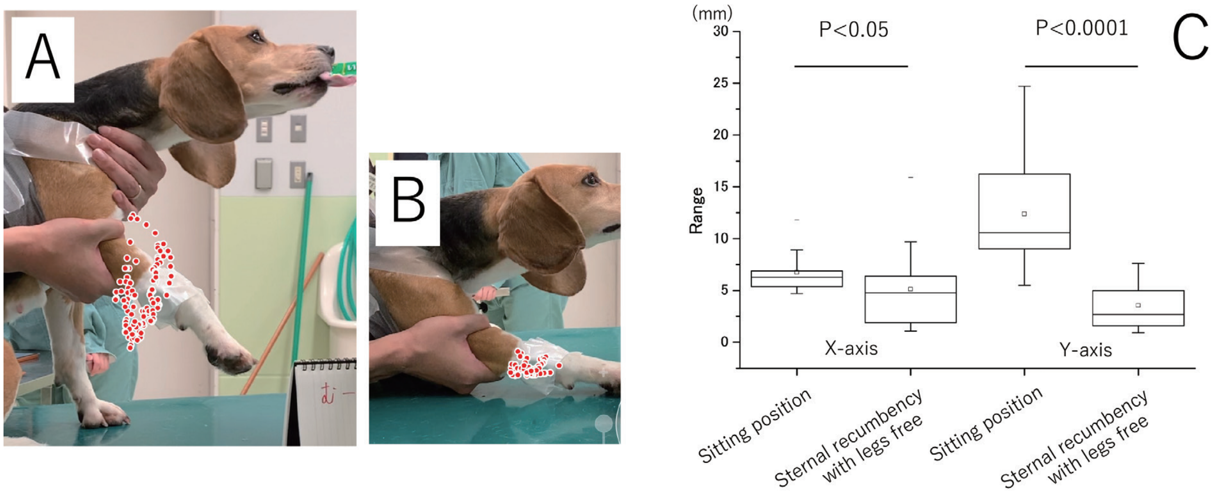

Fig. 3　Example plots of forelimb motion in the sitting position (A) and sternal recumbency with the legs free (B). The range of motion in the sitting position and sternal recumbency with the legs free is shown as a box plot (C). Box and whiskers indicate 25–75% and 5–95%, respectively. The sitting position showed a significantly wider range of motion of the forelimb than sternal recumbency with the legs free ($p < 0.0001$).

Discussion

Our findings demonstrated three characteristics of sternal recumbency with the legs free in obedient beagle dogs. First, there were no occurrences of complications. Second, it reduced the range of motion of the forelimb and shoulder since the dogs could not lift themselves from the table. Third, sternal recumbency with the legs free showed a lower height of the eye coordinate than the sitting position.

Safety precautions were taken before and during physical restraint[3,9]. There have been few reports of complications with restraining of patients[4,7,10-13]. In sternal recumbency, it is recommended that the handler leans some of his/her body weight on top of the dog to keep it down[2]. We believed that this would make the dog’s belly touch the examination table and increase the intra-abdominal pressure. However, it was not necessary since the dogs could not lift the body from the examination table. There were no complications with the sternal recumbency with the legs free; moreover, it allowed a shorter setting time than the sitting position. Therefore, sternal recumbency with the legs free should be considered in clinical settings.

Sternal recumbency with the legs free reduced the range of motion of the forelimb and shoulders; moreover, there was no occurrence of lifting the body (abdomen) from the examination table in sternal recumbency. Additionally, it involved less shoulder and forelimb movement than the sitting position. Taken together, sternal recumbency with the legs free might facilitate the handling of dogs, even problematic ones.

Sternal recumbency is usually used on the examination table and sometimes on the floor with large dogs[2,3]. Restraining in the sitting position is considered difficult when the head position is high. Based on the eye coordinate, we found that sternal recumbency with the legs free had a lower height than the sitting position. Accordingly, sternal recumbency with the legs free might facilitate the handling of dogs, including large ones.

This study has several limitations. First, this study had a small sample size and only used a single dog breed. Second, we selected the sitting position for comparison since most procedures can be performed with the dog in a standing or sitting position[4]. Finally, the body position influences intraocular pressure[12], blood pressure[14], swallowing and esophageal transit[13], and acquisition of computed tomography images[11]. Sternal recumbency with the legs free may increases intra-abdominal pressure and affect those clinical conditions if the dog’s belly is in direct contact with the examination table and the dog's own weight is on its belly. Therefore, sternal recumbency with the legs free may be unsuitable to examine such clinical conditions. There were no cases where the belly directly contacted the examination table; however, we considered it preferable to place a cushion/towel on the examination table.

Our findings demonstrated that sternal recumbency with the legs free could sufficiently restrain obedient beagle dogs without any complications. Low-stress handling will result in improving the safety of the staff and patients[4]. Sternal recumbency with the legs free has a possibility to provide not only the ease of treatments, but also the safety of the veterinary staff and dogs. However, we did not include other breeds and problematic dogs. Therefore, further studies using large and small breed dogs and fractious dogs in clinical settings are warranted for the safety of the veterinary staff and dogs.

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