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X-RAY EVALUATION OF PROXIMODISTAL ALIGNMENT OF CANINE PATELLA

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Abstract
This study used radiographic techniques to evaluate the Insall Salvati index (ratio of the length of the patellar ligament to the length of the patella - L:P) to compare the verticality patellar position at small-medium and large breed dogs that were grouped in healthy dogs, dogs with patellar luxation and with cranial cruciate ligament ruptures. Except for the based on L:P ratio measurement at small-medium breed dogs and in large-breed there was no difference among the groups. In large large-breed dogs the LPL is associated with patella baja. No statistically significant differences of L:P ratio between dogs affected or unaffected with cranial cruciate ligament rupture are reported
Further studies using other imaging techniques are required in small and large-breed dogs with patella luxation (LPL and MPL).

Key words*: dog, Insall Salvati index, stifles*

INTRODUCTION

Blumensaat (1938) first described in radiographic technique for measuring human patella. Over time in human medicine have been reported nine radiographic measurement techniques (Phillips et al., 2010).
In veterinary medicine, to date, there are relatively few studies on evaluation methods proximal-distal alignment of the patella in dogs. Johnson et al. (2002) presents the first data on radiographic examination of verticality patellar position on the corpses of large dogs, taking in human medicine technique Insall Salvati (1971).
Johnson et al. (2006) presents the first comparative measurements of the index Insall Salvati to healthy dogs and dogs with large medial patella luxation. Mostafa et al. (2008) shows the medium and large dogs (healthy, with medial dislocation and lateral patellar dislocation respectively) two types of assessments by radiographic techniques: the ratio of the tibio-patellar ligament length / length of the patella (index Insall Salvati) and axis length ratio of the length of the femur and patella transcondiliar (technical taken from human medicine (Carson et al., 1984) and modified by the author). Another report is of Knazovicky et al. (2012) with data obtained in normal dogs and dogs with cranial cruciate ligament rupture after evaluation index Insall Salvati. Proximal-distal alignments abnormal patellar two pathological situations include: - *patella alta* or patella high, the patella is located in the proximal portion of the femur trochlear groove and - *patella baja* (patella infera) or low patella, the patella is located in the portion distal of the femur trochlear groove.
A recent study (Mostafa et al., 2008) believes that high patella dislocation is responsible for the appearance and medial patella dislocation and patella infera for lateral nontraumatic dislocation.

MATERIALS AND METHODS

Medical records (2012-2014) were reviewed to identify small-medium or large breed dogs that were examined by radiographs (lateral stifle radiographs). Medical and radiographic records (based on physical examination and preoperative and diagnosis registered) allowed the establishment of followings groups: group 1 - healthy small-medium dogs (< 15 kg body weight); group 2 - healthy large dogs (> 15 kg body weight); group 3 - small-medium dogs (< 15 kg body weight) with medial patellar luxation (MPL); group 4 - large dogs (> 15 kg

body weight) with lateral patellar luxation (LPL); group 5 - small-medium dogs (< 15 kg body weight) with uni- or bilateral cranial cruciate ligament ruptures; group 6 - large dogs (> 15 kg body weight) with uni- or bilateral cranial cruciate ligament ruptures.

Inclusion criteria were: skeletally mature (>1 year of age), no other orthopedic abnormalities in that stifle and presence of a good quality straight lateral radiograph of that stifle.

Single lateral stifle radiographs from each dog (1-6 groups) were examined by method described of Johnson et al. (2002) that define the vertical position of the patella as the ratio of the length of the patellar ligament to the length of the patella (L:P) – figure 1. All measurements (three for each radiograph) were performed using a digital caliper (L-4C300 Kennon-Italia).

All statistical analyses were performed using Microsoft Windows version 6.3 a computer software statistic program. The resulting data were expressed as mean ± standard deviation (±SD). The differences between groups were analyzed with a non-parametric test - Wilcoxon Signed Ranks test (IBM SPSS Statistic 2.0). For values of $p \leq 0.05$ considering significant differences and for $p < 0.001$ highly significant. The 95% confidence limits of the group were also estimated.

RESULTS AND DISCUSSIONS

The results are presented in table 1. Sixty-six dogs were identified that fit the inclusion criteria for the group 1. Mean (± SD) body weight was 9.0 ± 3.1 kg and mean age was 3.1 ± 2.4 years. Ninety seven dogs were identified that fit the inclusion criteria for the group 2. Mean (± SD) body weight was 29.0 ± 9.0 kg and mean age was 3.3 ± 3.5 years

Eighteen dogs were identified that fit the inclusion criteria for the group 3. Mean (± SD) body weight was 8.0 ± 3.3 kg and mean age was 3.9 ± 2.5 years. Seventeen dogs were identified that fit the inclusion criteria for the group 4. Mean (± SD) body weight was 26.0 ± 3.0 kg and mean age was 4.3 ± 1.5 years.

Seventeen dogs were identified that fit the inclusion criteria for the group 5. Mean (± SD) body weight was 8.0 ± 3.2 kg and mean age was 5.9 ± 3.5 years. Twenty- eight dogs were identified that fit the inclusion criteria for the group 6. Mean (± SD) body weight was 31.0 ± 9.5 kg and mean age was 6.8 ± 3.0 years.

Means (± SD) of L:P were: group 1 = 1.71 ± 0.26, group 2 = 1.80 ± 0.2. Our results indicate that the normal vertical patellar position, based on L:P measurement, in small-medium breed dogs is between 1.64 and 1.77 (95% CI) and in large-breed dogs is between 1.76 and 1.84 (95% CI). This data, for large-breed dogs, are comparable with another reports (Johnson et al. 2006, Mostafa et al., 2008).

Difference between groups 1 and 2 found a statistically significant (p=0.039).

Means (± SD) of L: P were: group 3 = 1.79 ± 0.18, group 4 = 1.97 ± 0.24. Difference between groups 3 and 4 found a statistically no significant (p=0.109).

Means (± SD) of L: P were: group 5 = 1.62 ± 0.17, group 6 = 1.79 ± 0.23. Difference between groups 5 and 6 found a statistically significant (p=0.011).

Statistical analysis of data from healthy animals with groups of dogs with patellar luxation (medial or lateral), respectively group 1 to group 3 and group 2 to group 4, did not find statistically significant differences. Either way based on L:P measurement recorded in large large-breed dogs with LPL (1.97) are similar with values reported by Mostafa et al. (2008). (L:P=1.90).

In large large-breed dogs LPL is associated with patella baja. . Our results indicate that the MPL, based on L:P measurement, in small-medium breed dogs is between 1.37 and 2.57 (95% CI), mean 1.79. By comparing these values with data reported Mortari et al. (2009), respectively a ratio L:P between 1.84-1,9 at medium-small dogs with MPL and we can't confirm findings reports by Mostafa et al. (2008) in large breed dogs such as MPL is associated with patella alta.

Also statistical analysis of data from healthy animals with groups of dogs with cranial cruciate ligament ruptures, respectively group 1 with group 5 and group 2 to group 6 did not find statistically significant differences. Similar data of L:P ratio between dogs affected or unaffected with cranial cruciate ligament rupture was reported (Kňazovický et al., 2012).

Table 1. Mean values for the L:P ratio obtained by radiographic measurements at dogs with clinically normal stifle joints (groups 1 and 2) , dogs with MPL (group 3) and LPL (group 4) and dogs with cranial cruciate ligament ruptures (group 5 and 6)

Group	n dogs	Weight (mean) – kg (± SD)	Age (mean)– years (± SD)	Patella length (mean) –mm (± SD)	Ligament length (mean) – mm (± SD)	L/P (mean) (± SD)
1	66	9 (± 3.1)	39 (± 2.4)	14.07 (± 3.30)	26.28 (± 7.54)	1.71 (± 0.26)
2	97	29 (± 9.0)	3.3 (± 3.5)	22.51 (± 3.42)	40.62 (± 7.93)	1.80 (± 0.20)
3	18	8 (± 3.3)	3.9 (± 2.5)	11.77 (± 1.46)	20.94 (± 2.99)	1.79 (± 0.18)
4	17	26 (± 3.0)	4.3 (± 1.5)	18.34 (± 4.95)	35.43 (± 5.11)	1.97 (± 0.24)
5	17	8 (± 3.2)	5.9 (± 3.5)	13.41 (± 2.38)	21.61 (± 4.31)	1.62 (± 0.17)
6	28	31 (± 9.5)	6.8 (± 3.0)	21.75 (± 3.34)	38.73 (± 7.07)	1.79 (± 0.23)

CONCLUSIONS

Further studies using other imaging techniques are required in small and large-breed dogs with patella luxation (LPL and MPL) due to the difficulty in obtaining a clear , well defined and precise parameter for evaluation of the proximo-distal alignment of the patella with respect to the femoral trochlea, distal aspect of the femur, and proximal aspect of the tibia.

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