

Breed, gender, age and reproductive status in relation to the predisposition for cranial cruciate ligament rupture in 117 dogs treated by a single surgeon (2010 - 2015) - a short communication

Marko Pećin*, Marija Lipar, Josip Kos, Ozren Smolec, Mario Kreszinger, and Marko Stejskal

Clinic for Surgery, Orthopaedics and Ophthalmology, Faculty of Veterinary Medicine, University of Zagreb, Zagreb, Croatia

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ABSTRACT

Rupture of the cranial cruciate ligament (CCL) remains the most common canine orthopaedic problem seen in clinical practice. The present paper describes a population of 117 dogs with CCL rupture diagnosed by clinical examination followed by mini-arthrotomy. The dogs were treated from January 2010 to February 2015 at the Clinic for Surgery, Orthopaedics and Ophthalmology, Faculty of Veterinary Medicine, University of Zagreb, Croatia, by the same surgeon. The age, breed, gender and reproductive profile were analysed in relation to CCL rupture occurrence during the study and were discussed in relationship to previous published reports. Of the 117 dogs, 29.0% were mixed breed dogs and 13.7% Labrador Retrievers as the most common. Males and females were equally affected. Bilateral rupture occurred in 5.85% cases, mostly in mixed breed females. Medial meniscal tear was observed in 22.2% of cases with mini-arthrotomy and probing. The average age of the small breed dogs was 8.3 years, and of the large breed dogs 4.2 years. Dogs aged 5 years and older had 2.5 times the likelihood of suffering from CCL rupture compared with dogs aged under 5 years ($P < 0.01$).

Key words: cranial cruciate ligament, rupture, breed, age, gender, meniscal tear, dog

Introduction

Cruciate disease is a common cause of chronic pelvic limb lameness in dogs. Mid-substance rupture of the cranial cruciate ligament (CCL) arises from progressive pathological failure, often under conditions of normal loading in adult dogs with CCL instability. The high incidence of rupture in older dogs is associated with inflammation of

*Corresponding author:

Marko Pećin, PhD, DVM., Senior Assistant, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, 10000 Zagreb, Croatia. Phone: +385 1 2390 391; Fax: +385 1 2390 380; E-mail: mpecin@vef.hr

the synovium and degenerative changes in the cells and matrix of the CCL, in contrast in puppies it is usually associated with traumatic injury and avulsion of the CCL from its sites of attachment (HAYASHI et al., 2004). Breed predisposition has been detected in Neapolitan Mastiff, Akita, Saint Bernard, Rottweiler, Mastiff, Newfoundland, Chesapeake Bay Retriever, Labrador Retriever, and American Staffordshire Terrier (CORR, 2009) breeds, while the Greyhound has a dramatically reduced frequency of this disorder, supporting the heritable basis of the CCL rupture trait (BAIRD et al., 2014). Increased incidence has also been detected for neutered males and females with a slight majority of females, as well as for older dogs with an average age of 7 years in an earlier study (HARASEN, 2003).

Meniscal damage is common in dogs with naturally occurring CCL rupture (FITZPATRICK and SOLANO, 2010). Injury of the medial meniscus presents a major problem if it is not diagnosed properly. This retrospective study has the goal of determining the percentage of meniscal damage in dogs undergoing CCL rupture surgery in a time period of 5 years, who were treated by one surgeon.

There has not been any previous study discussing the incidence of CCL rupture in the canine population in Croatia. The goal of this study was to describe the factors related to CCL rupture: breed, age, gender and reproductive status in dogs from 2010 to 2015, at one clinic, and treated by a single surgeon.

Materials and methods

The present study included 117 dogs of both sexes, various breeds and ages, that had shown clinical signs of pelvic leg lameness secondary to CCL rupture. Specific tests included the cranial drawer test and the tibia compression test. Dogs with patellar luxation or another musculoskeletal disease were excluded from the study, as well as dogs with other skeletomuscular degenerations, apart from two of them with hip dysplasia (HDB). This was a retrospective study: the medical records of a first-opinion veterinary practice were researched for dogs diagnosed with cranial cruciate ligament rupture from January 2010 to early 2015. All surgical procedures were performed at the Clinic for Surgery, Orthopaedics and Ophthalmology, Faculty of Veterinary Medicine, University of Zagreb, Croatia, by a single surgeon (MP). The choice of surgical technique depended on the animal size, condition, activity level and the financial status of the owner. The procedures included medial mini-arthrotomy, exploration of the joint, inspection and probing of the meniscus, debridement of ligament remnants, and joint capsule reconstruction, followed by the tibial tuberosity advancement (TTA; Kyon, Securos) in 50 dogs and modified retinacular imbrication technique (MRIT) in 67 dogs. The breed, gender, age and reproductive status data in the population of 117 dogs were collected presented and discussed. Statistically significant results were considered as $P < 0.01$. Also, the incidence

of meniscal injury was recorded and discussed in comparison with previously published studies.

Results and discussion

Mixed breed dogs had a greater incidence of CCL rupture, comprising 34 out of the 117 (29%) dogs included in the study. Of the 117 dogs, there were 31 different breeds. Large breed dogs comprised 79.3%, while small breed dogs comprised 20.5% of all dogs. The incidence of CCL rupture by breed in this study is presented in Table 2. The percentage of neutered dogs of both sexes was 23.1%. Of the total 117 dogs, 56 were intact males, one castrated male, 34 intact females, and 26 females that had undergone ovariectomy (OHE) or ovariectomy (OVE) at some point prior to the this study. The incidence of CCL rupture in castrated males and was 1.75% (1/57) and females 43.3% (26/60) respectively. The mean age of the dogs included in the study was 6.4 years, ranging from 8 months to 12 years. The youngest dog, an 8 month old male Labrador Retriever, sustained complete CCL rupture during play. The mean age of both sexes was 5.5 years, with the mean age of 5.56 years in intact males, and 5.6 years in intact females. In neutered females the mean age was 5.84 years. There was only one castrated male dog, aged 4 years. The mean age of small breed dogs was 8.3 years, of large breed dogs 4.2 years. Mixed breed dogs, as the most common breed in this study had CCL rupture at an average age of 7.7 years. Dogs aged 5 years and older had 2.5 times the odds of CCL rupture compared with dogs aged less than 5 years, $P < 0.01$.

Table 1. Incidence of CCLR from 2010-2015 regarding dog age. Age is displayed in years, n-number of dogs from the total of 117, P - statistically significant; n.s. - not significant.

Age	Number	Percentage %	P value
<2.0	3	2.6	n.s.
2.0-4.9	30	25.6	n.s.
5.0-7.9	48	41.0	$P < 0.01$
>8.0	36	30.7	n.s.

There is a strong breed-related predisposition to CCL rupture in dogs (BAIRD, 2014). West Highland White Terriers, Yorkshire Terriers and Rottweilers had a significantly higher prevalence of CCLR, and Rottweilers had five times greater incidence compared with other pure breeds, with females twice as likely to suffer CCLR compared to males (ADAMS et al., 2011). In our retrospective study, dogs younger than 2 years accounted for only 2.6% of total dogs, and those older than 8 accounted for almost 31%. There was a statistically significant difference in 5 to 8 year old dogs, with a total of 41% (48/117), $P < 0.01$ (Table 1). In the study by TAYLOR-BROWN et al. (2015) dogs aged over 3 years

had increased odds of diagnosis of CCL rupture compared to dogs aged less than 3 years. Rottweilers and Golden Retrievers have been cited as breeds in which CCL disease is common (HARASEN, 2003). Compared to the studies by HARASEN et al. (2003), ADAMS et al. (2011) and TAYLOR-BROWN et al. (2015), we noticed a lower incidence of CCL rupture in Rottweilers (5.1%) and in West Highland Terriers and Yorkies (0.85%). On the other hand, Labradors and mixed breeds had a greater incidence of CCL rupture (21%). Dogs less than 5 years of age represented only 28% of the total of 117 dogs and those older than 5 years of age represented 72%. Dogs aged 5 years and older had 2.5 times the odds of CCL rupture compared with dogs aged under 5 years, and this was seen in this study as the most interesting and statistically significant find ($P < 0.01$). Also we noticed that mixed breed dogs had the greatest incidence of CCL rupture, with 29% ($n = 34$ dogs) as they were overrepresented in our study. A similar incidence in mixed breed dogs was noted by BELLUMORI et al. (2013).

Table 2. Breed distribution in a retrospective study from 2010-2015 of dogs undergoing CCLR surgery. Mixed breed was the most common breed in Croatia

Breed	Percentage	N
Mixed breed	29.0%	34
Labrador retrievers	13.7%	16
Maltezers	6.0%	7
Rottweiler / German boxer	10.2%	12 (6 of each breed)
American Staffordshire Terrier	4.3%	5
Beagle / Bernese Mountain Dog	6.8% (3.4% each)	8 (4 of each breed)
Doberman Pincher / Dogo Argentino / English Bulldog	7.7% (2.55% each)	9 (3 of each breed)
Bullmastif / Pekinese/Central Asian Shepherd Dog	7.7% (2.55% each)	9 (3 of each breed)
Bichon Frise / Cane Corso / English Cocker Spaniel/ Great Dane/Mastiff/Dachshund / Samoyed/Golden Retriever / German Shepherd Dog / German Hunting Terrier /Sibirian Husky / Shih Tzu / Swedish Spitz / Tibetan Terrier / German Bird Dog /Yorkshire Terrier and West Highland Terrier	14.5% (0.85% each)	17 (one of each breed)

Other retrospective studies have shown that the prevalence of CCL rupture in dogs increases with age, with a peak prevalence in dogs 7 to 10 years old (HARASEN, 2003). A common theme of many publications has been that CCL disease is becoming a condition of young, large breed dogs (BENNETT et al., 1988; JOHNSON and JOHNSON, 1993; DUVAL et al., 1999). Smaller breed dogs may rupture their cranial cruciate ligament (CCL) later in life than larger breed dogs because of slower CCL degeneration (WILKE et al., 2006). Similar age and breed differences were noticed in our population of dogs.

An increased prevalence was detected for neutered dogs, in comparison with sexually intact ones found in earlier published studies (HARASEN, 2003), where a significant majority of females (65% female) was noticed. Published studies consistently describe more females than males with rupture of the CCL; in some cases there is only a slight majority of females (JOHNSON and JOHNSON, 1993). A similar observation was made in this retrospective study with 51.3% females. In this study, regardless of castration status, the incidence of CCL rupture in both sexes was almost the same, with 60 females vs. 57 males. Following multi-variable analysis, it was established that neutering was not associated with any increased prevalence of cranial cruciate ligament rupture (DUVAL et al., 1999). In one study, females that had undergone ovariohysterectomy and males that had undergone orchiectomy had a significantly higher prevalence of CCL rupture than sexually intact dogs (SLAUTERBECK et al., 2004). The total percentage of neutered dogs in our study was lower than in previous published studies, with only 20.5%. The discrepancy in the number of neutered male dogs v. females in Croatia, with a total of only 1/57 (1.8%), is likely due to poor owner compliance with male castration. A similar incidence of CCL rupture was noticed in castrated females and intact males.

In our study, bilateral rupture occurred in 5 cases (5.85%), mostly in spayed mixed breed Labrador/ Labrador females (3), with a mean age of six years. One was a castrated male Rottweiler, aged 6. The study published by GRIERSON et al. (2011) suggested a possible relationship with the incidence of bilateral rupture occurring as more likely in young male dogs, with a mean age of four years (4.3 ± 2.7 years) and in Rottweiler dogs. Due to there being only one case of bilateral rupture in a Rottweiler in this retrospective study it is not possible to determine the incidence. There is some relationship between spayed female and bilateral CCL rupture in our study. We noticed that 60% of dogs that had a bilateral rupture were spayed females. In our case 60% of dogs (3/5) were mixed (not pure breed) Labradors with contralateral rupture within one year after primary CCLR surgery. These figures are similar to those reported elsewhere (MOORE and READ, 1995). A long term study is needed to assess the true percentage of bilateral rupture in a similar population of dogs.

A medial meniscal tear was observed in 26 dogs, or 22.2% of cases. Due to the retrospective nature of this study, in the time period mentioned arthroscopy had not yet been introduced as the standard method of meniscal tear diagnostics. Therefore, the lower incidence of meniscal tear (22.2% or 26/117 dogs) could be due to the lack of arthroscopy usage. Nevertheless, meniscal probing was a standard for mini-arthrotomy in this study. In a retrospective study by HAYES et al. (2010), 36.3% dogs had a medial meniscal tear. During stifle joint arthrotomy, diagnosis of a medial meniscal tear is routinely made by observation and probing. Despite recognition of arthroscopy as the reference standard for diagnosing medial meniscal tears (MAHN et al., 2005), arthrotomy is still most

commonly used at our clinic. The comparison of meniscal injury findings of this study with arthroscopy performed during meniscal inspection could be a goal of future studies at our clinic.

In conclusion, Labradors and mixed breeds had increased incidence of development of CCL disease and ligament rupture in this retrospective study. Increased age was identified as the most interesting factor for development of CCL disease. Dogs aged 5 and more had 2.5 times the chance of CCL rupture compared with dogs aged under 5 years ($P < 0.01$). The populations of males v. females was similar. Spayed female dogs had almost the same incidence of CCL rupture as intact ones. The medial meniscus was commonly injured during CCLR, but at a rate lower than in previously published studies

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SAŽETAK

Ovo istraživanje obuhvaća populaciju od 117 pasa s puknućem prednjega križnog ligamenta dijagnosticiranim kliničkim pregledom i medijalnom miniartrinomijom. Psi su bili zaprimani i liječeni od siječnja 2010. do veljače 2015. godine na Klinici za kirurgiju, ortopediju i za oftalmologiju Veterinarskog fakulteta Sveučilišta u Zagrebu. Klinički pregled i operacije obavio jedan te isti kirurg. Analizirana je dobna, pasminska, spolna i reprodukcijaska predispozicija pasa za puknuće prednjeg križnog ligamenta. Rezultati su uspoređeni s rezultatima ranije objavljenih radova. Od ukupno 117 pasa najzastupljeniji su bili križani psi (29,0 %) i labrador retrieveri (13,7 %). Ženke i mužjaci bili su podjednako zastupljeni, neovisno o sterilizaciji. Obostrano puknuće križnog ligamenta zabilježeno je u ukupno 5 slučajeva, najviše u kuja križanih pasmina s prosječnom dobi od šest godina. Ozljeda medijalnog meniskusa zabilježena je u 22,2 % slučajeva nakon miniartrinomije i inspekcije sondom. Prosječna dob u malih pasmina bila je 8,3, a u velikih pasmina 4,2 godine. Psi stariji od pet imali su 2,5 puta veću pojavnost puknuća prednjeg križnog ligamenta nego psi mlađi od 5 godina ($P < 0,01$).

Ključne riječi: prednji križni ligament, puknuće, pasmina, dob, spol, ozljeda meniskusa, pas
