Management of cranial cruciate ligament rupture in small dogs: A questionnaire study

E. Comerford1; K. Forster2; K. Gorton2; T. Maddox2

1Institute of Ageing and Chronic disease and School of Veterinary Science, Leahurst Campus, University of Liverpool, Neston, Wirral, UK; 2Small Animal Teaching Hospital, School of Veterinary Science, Leahurst Campus, University of Liverpool, Neston, Wirral, UK

Objectives: To survey the current management of cranial cruciate ligament rupture in small dogs (<15 kg) by veterinarians.

Methods: A questionnaire was distributed to veterinarians attending the British Veterinary Orthopaedic Association Spring meeting and British Small Animal Veterinary Association Annual Congress which took place in April 2010. Respondents were surveyed on their management of small dogs with cranial cruciate ligament rupture.

Results: Immediate surgical management was chosen by 15.5% of the respondents. Following that, 77.6% of respondents suggested that case management would depend on severity of lameness (81%), age (72.6%), bodyweight (70.4%), degree of instability (64.8%), and duration of lameness (64.0%). Conservative management included non-steroidal anti-inflammatory drugs (91.1%), short leash walks (91.1%), weight loss (89.0%), hydrotherapy (53.6%), physiotherapy (41.9%), and cage rest (24.2%). Where surgical management was chosen, 71.4% would perform the procedure rather than refer it to another practice. Surgical techniques included extra-capsular stabilisation (63.4%), corrective osteotomies (32.9%), and intra-articular stabilisation (6.8%). The demographic characteristics of the responding veterinarians had no effect on their initial management of the case. General practice veterinarians were less likely to perform a corrective osteotomy than to refer the case, but were no less likely to perform an extra-capsular technique.

Clinical significance: Conservative management is still widely used for treatment of cranial cruciate ligament rupture in dogs weighing less than 15 kg; this is in agreement with previous publications on the management of this condition in small dogs.

Introduction

Few studies have described conservative or non-surgical management of cranial cruciate ligament rupture in small dogs (<15 kg) (1-3). Methods reported for the conservative management of cranial cruciate ligament rupture in small dogs include weight reduction, restriction of activity, and the administration of analgesic medications (1). The reported success of conservative management, based on subjective lameness assessment and stifle range-of-motion, in small breed dogs weighing 20 kg or less, ranges from 84% to 90% (1, 3).

Over the last 30 years, an increase in the number of techniques used in the surgical management of cranial cruciate ligament rupture has occurred, the methods being broadly divided into intra-articular, extra-articular and periarticular techniques. Reported intracapsular methods of stabilisation include the ‘over the top’ technique using tissues such as skin or fascia and artificial material such as polyester (4, 5). Commonly used extracapsular stabilisation techniques include capsular imbrication, circumfascial prostheses, suture anchors, and bone tunnels with braided polyester coated polyethylene (6-9). More recently, osteotomy techniques have been reported for stabilisation of cranial cruciate ligament rupture in small dogs, including cranial closing wedge osteotomy, tibial plateau levelling osteotomy, and tibial tuberosity advancement (10-12).

Therefore, given the recent increase in surgical options for the management of cranial cruciate ligament rupture, it was our aim to survey current practices in the management of small dogs with cranial cruciate ligament rupture by a population of small animal veterinarians.

Materials and methods

Questionnaire design and distribution

A questionnaire was designed to assess current methods used in the management of cranial cruciate ligament rupture in small dogs (<15 kg). The questionnaire was composed of two sections (►Appendix 1; available online at www.vcot-online.com).
Section A was composed of three questions which assessed: 1) general demographics of the veterinarian, including year of graduation, 2) type of practice (small animal/mixed), and 3) position within the practice (partner/assistant). Section B was composed of seven questions, all of which assessed management of cranial cruciate ligament rupture in dogs less than 15 kg. Ethical approval for the use of data collected in this study was obtained from the University of Liverpool ethical review committee.

Following initial piloting, the questionnaire was distributed to all attendants at the British Veterinary Orthopaedics Association Spring meeting 2010 and randomly selected delegates at one day of the British Small Animal Veterinary Association annual congress which took place during April 2010. Delegates at both meetings included veterinarians working in mixed practice, small animal practice, and specialist referral orthopaedic practice. All respondents had to be qualified veterinarians working in a small animal or mixed veterinary practice. Most questions consisted of selection of the most appropriate response and multiple responses were possible for several questions. Free text responses were provided for year of graduation and as an option for most questions. For several questions a ‘don’t know’ option was given in order to avoid respondents guessing the answer (13).

Statistical analysis
Data were analysed using the SPSS statistical software package\(^a\). Independent variables were derived from the questionnaire (years since graduation, position within practice and type of practice). For categorical variables with many categories or containing only small numbers, categories were combined into appropriate larger classes. For the continuous variable of years since graduation, a test for linearity was applied to determine whether analysis could be undertaken with an assumption of linear association, and normality of distribution was assessed using the Kolmogorov-Smirnov test. Associations between respondent demographic variables, and the initial and subsequent surgical management of the case, were assessed using multinomial logistic regression analysis. Statistical model outcomes were expressed in terms of relative risk ratios, which describe the ratio between the relative probabilities of the outcomes concerned versus the defined reference outcome. Univariable multinomial logistic regression was used to calculate measures of strength of association (crude relative risk ratios) for the respondents’ demographic variables with each outcome, and variables with a p-value <0.25 were considered for incorporation into a final multivariable. For any variables with a correlation coefficient of ≥0.70, only the variable with the smallest p-value was considered for further analysis. The final models were constructed by a manual backwards stepwise procedure, where variables with Wald and likelihood ratio test p-values <0.05 were retained in the model.

Results
Questionnaire response rate
In total 200 questionnaires were used in the study and were returned by 169 veterinarians. Eight questionnaires were not valid for use due to incomplete responses. In total, 113 responses (70%) were received from veterinarians attending the British Veterinary Orthopaedic Association meeting and 48 (30%) were received from veterinarians attending the British Small Animal Veterinary Association congress.

Questionnaire results
Section A: Demographic data

![Figure 1](https://example.com/image1.png)

**Figure 1** Frequency histogram of the number of years since graduation in a questionnaire survey of 161 veterinarians (normal distribution curve superimposed).

**Year of graduation**
The median number of years since graduation was 11 years (range one to 45, interquartile range two to 20), with a non-normal distribution. A skew towards recent graduates was identified within the data (Figure 1).

**Type of practice**
Overall, 76% of respondents worked at a first opinion veterinary practice\(^b\), whilst 24% worked at referral institutes. Of those working in a first opinion practice, 53% of respondents worked in small animal first opinion, 13% worked in a mixed first...

---

\(^a\) SPSS 16.0 for Windows: SPSS Inc, Chicago, Illinois, USA

\(^b\) Comment from Editor-in-Chief: First opinion veterinary practice in the United Kingdom is the equivalent to general veterinary practice in other countries.
opinion practice, and 10% in ‘other practices’ including charity institutions. Ten percent and 14% of respondents worked in small animal multidiscipline referral and orthopaedic referral practices respectively.

Position within the practice
Assistants made up 54.6% of respondents, and 24% were partners. The remaining 22% were composed of residents, interns, PhD students, locums and part-time veterinarians.

Section B: Management of cranial cruciate ligament rupture in dogs <15 kg
Management of cranial cruciate ligament rupture in dogs <15 kg
Only 15.5% of respondents opted exclusively for surgical management of small dogs with cranial cruciate ligament rupture without consideration of any other factors. Of the remaining 84.5%; 6.8% suggested conservative management (non-surgical treatment) would be their immediate treatment of choice. For 77.6% of the respondents, it was suggested that the management would depend on individual assessment factors for each case.

Assessment criteria for management of cranial cruciate ligament rupture in dogs <15 kg
The factors considered by respondents when deciding on the management of cranial cruciate ligament rupture in dogs <15 kg are summarised in Table 1. Severity of lameness (81%), age (72.6%), body-weight/body condition score (70.4%), degree of instability (64.8%), and duration of lameness (64.0%) were most frequently considered. Expected work level (49.6%), breed (29.6%), and gender (4%) were considered by fewer respondents in their management of small dogs.

Methods of conservative management
The most popular methods of conservative management used in small dogs with cranial cruciate ligament rupture included non-steroidal anti-inflammatory drugs medication (91.1%), short leash walks (91.1%), weight loss (89%), hydrotherapy (53.6%), physiotherapy (41.9%), other drugs including tramadol hydrochloride, pentosan polysulphate, and paracetamol combined with codeine phosphate (33.1%) and cage rest (24.2%).

Of the respondents opting for conservative management: 61.0% would request re-examination of the patient within four weeks, whilst 37.5% would request re-examination within four to eight weeks. Of the respondents, 4.4% requested to re-examine the patient following an eight to ten weeks period, 7.1% suggested re-examination would depend on the degree of lameness, and 1.4% requested an examination within four to eight weeks. The factors considered by respondents when deciding on the management of cranial cruciate ligament rupture in dogs <15 kg are summarised in Table 1. Severity of lameness (81%), age (72.6%), body-weight/body condition score (70.4%), degree of instability (64.8%), and duration of lameness (64.0%) were most frequently considered. Expected work level (49.6%), breed (29.6%), and gender (4%) were considered by fewer respondents in their management of small dogs.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Summary of Section B questionnaire results assessing the management of cranial cruciate ligament rupture in small dogs (&lt;15 kg).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Do you manage CCLR in dogs &lt;15kg conservatively?</strong> (161 respondents)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>25 (15.5%)</td>
</tr>
<tr>
<td><strong>2. What factors are involved in your treatment decision?</strong> (125 respondents)*</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>90 (72.6%)</td>
<td>Gender</td>
</tr>
<tr>
<td>5 (4.0%)</td>
<td>Breed</td>
</tr>
<tr>
<td>37 (29.6%)</td>
<td>Body weight / BCS</td>
</tr>
<tr>
<td>88 (70.4%)</td>
<td>Severity of lameness</td>
</tr>
<tr>
<td>101 (81.0%)</td>
<td>Duration of lameness</td>
</tr>
<tr>
<td>80 (64%)</td>
<td>Degree of instability</td>
</tr>
<tr>
<td>81 (64.8%)</td>
<td>Expected work level</td>
</tr>
<tr>
<td>62 (49.6%)</td>
<td></td>
</tr>
<tr>
<td><strong>3. If you decide on conservative management, which time period would you re-examine the patient?</strong> (136 respondents)</td>
<td></td>
</tr>
<tr>
<td>0-4 weeks</td>
<td>83 (61.0%)</td>
</tr>
<tr>
<td><strong>4. What methods of conservative management do you employ for CCLR in dogs &lt;15kg</strong> (136 respondents)*</td>
<td></td>
</tr>
<tr>
<td>Short leash walks</td>
<td>124 (91.9%)</td>
</tr>
<tr>
<td><strong>5. Following clinical improvement, would you continue to manage the case conservatively?</strong> (136 respondents)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>79 (58.1%)</td>
</tr>
<tr>
<td><strong>6. If surgery is required, do you perform the surgery?</strong> (161 respondents)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>115 (71.4%)</td>
</tr>
<tr>
<td><strong>7. Which surgical techniques do you use?</strong> (161 respondents)</td>
<td></td>
</tr>
<tr>
<td>Intra-articular method</td>
<td>11 (6.8%)</td>
</tr>
</tbody>
</table>

Percentage of respondents for each question are expressed in brackets. *Denotes questions with multiple responses.

CCLR = cranial cruciate ligament rupture; NSAID = non-steroidal anti-inflammatory drugs; OA = osteoarthritis; BCS = body condition score.
methods of surgical management

of the 161 respondents, 71.4% would perform the surgery themselves should surgical management be required, whilst 24.8% would refer the case for surgical management. of the surgical techniques performed; 63.4% would perform extra-capsular stabilisation, whilst 32.9% and 6.8% would perform corrective osteotomies and intra-articular (over the top) stabilisation respectively.

statistical associations between demographic variables and case management

number of years graduated did not demonstrate a significantly non-linear relationship with the responses considered, and thus was incorporated into the subsequent analyses. number of years graduated demonstrated some correlation with position within a practice, but this was not sufficient for either variable to be excluded from the multivariable analysis.

univariable multinomial logistic regression did not identify any of the demographic variables as having a significant association (p < 0.05) with the initial management of the case. furthermore, there were not any p-values < 0.25 identified and consequently no multivariable model could be constructed for this outcome. however, when considering the possible subsequent surgical management of the case, all demographic variables had a p-value < 0.25. multivariable analysis showed that longer qualified veterinarians were significantly more likely to perform any of the surgical techniques themselves rather than refer the case (p < 0.05). longer qualified veterinarians were more likely to perform a corrective osteotomy or to perform an extra-capsular technique than to refer the case. additionally, veterinarians working in a first-opinion practice were significantly less likely to perform a corrective osteotomy or intra capsular procedure than to refer the case, but were no less likely to perform an extra-capsular technique.

Discussion

The results of this questionnaire suggest that small animal veterinarians most commonly use conservative (non-surgical) treatment of small dogs with cranial cruciate ligament rupture with only 15.5% opting for immediate surgical management. This finding was surprising given the evolution of surgical techniques over the last 30 years. Only 6.8% of respondents suggested that conservative management would be their immediate treatment of choice suggesting that other factors were important in their decision-making in the management of small dogs with cranial cruciate ligament rupture. The severity of lameness (81%), age (72.6%), and bodyweight (70.4%) were the most frequently cited factors involved in the decision making process on how to proceed with the treatment of cranial cruciate ligament rupture in small dogs. Despite the importance given to the severity of lameness, owner and veterinarian assessment of lameness has been shown to be unreliable when compared with force plate analysis (14, 15).

Methods of conservative management commonly used by respondents included non-steroidal anti-inflammatory drugs (91.9%), short lead walks (91.9%), and weight reduction (89%). The vast number of peer reviewed publications documenting the efficacy of non-steroidal anti-inflammatory drugs are for the treatment of canine osteoarthritis and this is reflected by their use in over 90% of respondents in this study (16-18). However, it was surprising that a high number (33.1%) of respondents selected ‘other drugs’ including tramadol hydrochloride, pentosan polysulphate, glucosamine with chondroitin, and paracetamol with codeine phosphate. Whilst the use of a once daily formulation of tramadol has been demonstrated to be effective in the treatment of osteoarthritis in people, to the best of our knowledge there are currently no published clinical trials for its use, or that of paracetamol, in the management of osteoarthritis in dogs (19). Other compounds such as green-lipped mussels, polysulfated glycosaminoglycans, prescription diets, pentosan polysulphate, and hyaluronan have been reported for use in the treatment of osteoarthritis, but few studies have reported their specific use for osteoarthritis secondary to cranial cruciate ligament rupture (20-23). The use of alternative therapies in the treatment of osteoarthritis remains questionable with only a moderate level of evidence existing for etodolac, pentosan polysulphate, green-lipped mussels, P54FP, and polysulfated glycosaminoglycans (24).

Body weight reduction has been shown to contribute significantly to a reduction in lameness scores and osteoarthritis development lending rationale for its recommendation in conservative management of cranial cruciate ligament rupture and associated osteoarthritis (25). Equally, a greater range-of-motion of the stifle joint has been reported in dogs receiving hydrotherapy post-surgical stabilisation of cranial cruciate ligament rupture compared to those receiving walking exercise alone, and dogs receiving physiotherapy post-surgical stabilisation for cranial cruciate ligament rupture had a higher peak vertical force, vertical impulse, thigh circumference, and range-of-motion than dogs that were exercise restricted (26–28). However, despite its reported benefits, as assessed by more robust and objective outcome measures, less respondents recommended physiotherapy (41.9%) compared with hydrotherapy (53.6%).

It is encouraging to note that none of the demographic variables assessed were significantly associated with the initial treatment of the case, suggesting that management is based on consideration of animal factors rather than the type of practice or level of experience or seniority of the respondent. One limitation of our data collection is the lack of information on the specialist status (RCVS/ACVS/ECVS) of the respondents from specialist referral orthopaedic practices. However it was assumed that respondents from these practices, though not all have specialist qualifications, would apply similar approaches to orthopaedic cases given the exclusivity of their caseload.

More surgical familiarity and less access to specialist equipment may explain the wide use of extracapsular techniques (63.4%) within this study. In addition, scientific evidence comparing the long-term success (in terms of osteoarthritis,
References


Acknowledgements

The authors would like to thank both the British Veterinary Orthopaedic Association and the British Small Animal Veterinary Association for allowing this survey to be performed during their Spring and Annual conferences respectively. We would also like to thank all of the veterinary surgeons who participated in this questionnaire study.

Conflict of interest

None declared.

© Schattauer 2013

Vet Comp Orthop Traumatol 6/2013

497