

on tibial tuberosity fractures in dogs younger than one year under UK primary veterinary care

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Project Background

Tibial tuberosity fractures are amongst the most commonly reported types of avulsion fracture in skeletally immature dogs¹.

There are no pathognomonic clinical signs, but patients typically present with signs of acute lameness due to inability to extend the stifle².

Prompt diagnosis can promote timely management of this painful condition.

Complications relating to malunion or secondary complications relating to treatment are possible sequelae^{3, 4}.

Previous overrepresentation of **Staffordshire Bull Terriers, Bull Terriers** and other **large breed** dogs raises the question of whether **muscle mass** is a risk factor in the aetiopathogenesis of tibial tuberosity fractures^{5, 6, 7}. There are few existing studies providing evidence for "**breed muscularity**" as a risk factor for tibial tuberosity fractures.

"Muscular" breeds:

- Fédération Cynologique Internationale (FIC) - Molossian breeds
- UK Bully Kennel Club – Bully breeds⁸
- Historical guarding/fighting breeds – Fila Brasileiro, Dogo Argentino, Japanese Tosa^{9, 10}



Bullmastiff



Cane Corso



French Bulldog



Dogo Argentino

Study aims: To report frequency, breed-related risk factors and clinical management for tibial tuberosity fractures in dogs under one year of age.

Methods

A retrospective cohort study design using VetCompass anonymised clinical records followed 232,056 dogs under one year of age during the date range from 1st of January 2019 to 31st of December 2020.

Included as a tibial tuberosity fracture case if:

- EHR (Electronic Health Records) showed evidence for diagnosis of a tibial tuberosity fracture
- Tibial tuberosity fractures associated with proximal tibial physeal fractures were also included¹¹

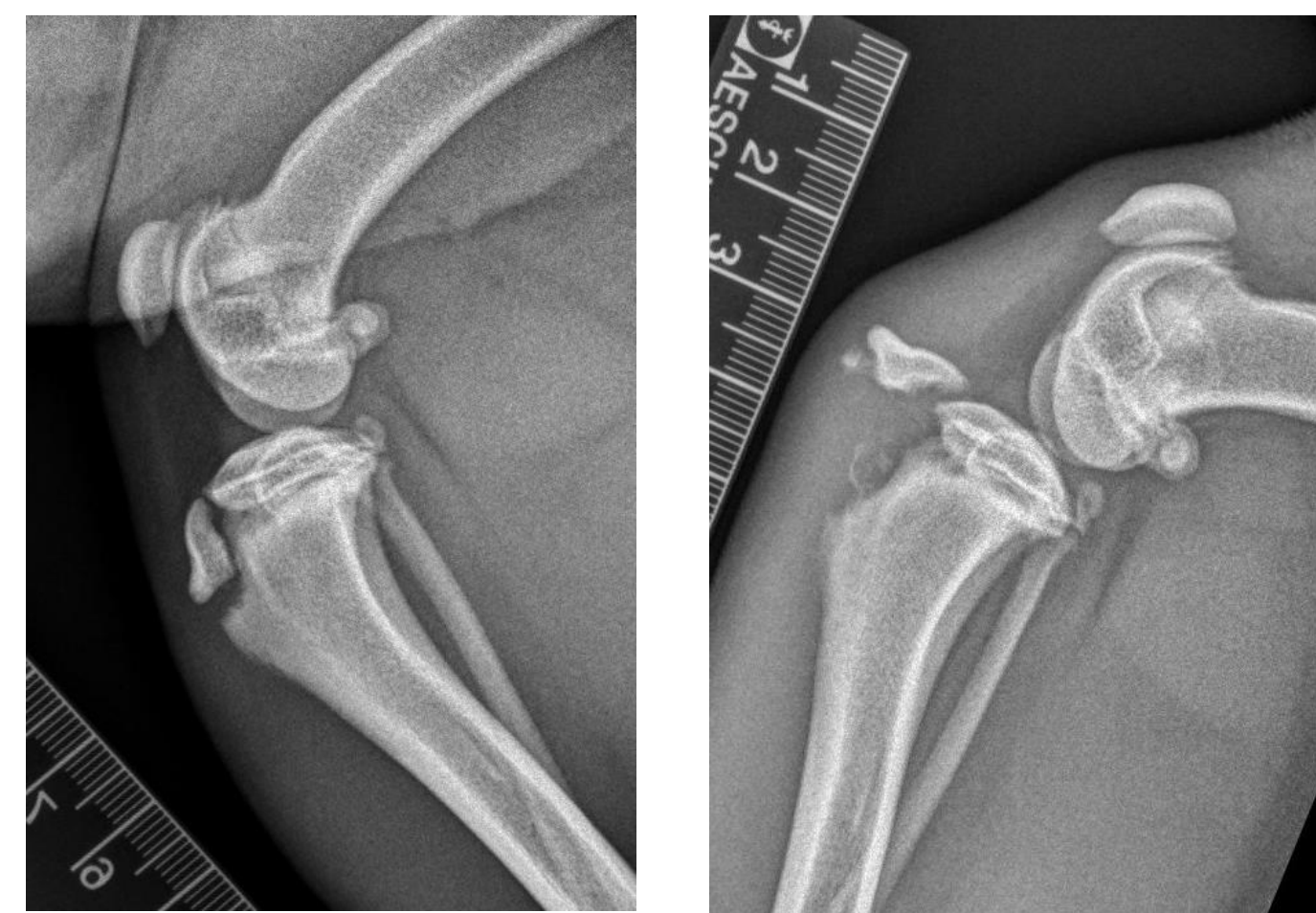


Fig. 1 (Left): Normal stifle in young patient, tibial apophysis still open. Fig. 2 (Right): Tibial tuberosity avulsion fracture with marked displacement of the tibial tuberosity fragment © Carlos Sanchez Villamil

Breed variable included:

Unique breeds with 2 or more tibial tuberosity fracture cases

Breed-related and non-breed derived variables were evaluated as risk factors using **multiple logistic regression modelling**, if liberal association was demonstrated using univariable evaluation.

Non-breed derived variables included in the study:

Sex

Breed-derived variables included in the study:

Muscularity, Spaniel Type, Median Adult Bodyweight

Results

Tibial tuberosity fracture cases identified in 249 of 232,056 dogs younger than one year. Annual incidence risk was 0.11% (95% CI 0.09-0.12).

Table 1: Breed-focused multivariable logistic regression accounting for sex as a variable. Results report associations between individual breeds and tibial tuberosity fractures in dogs under one year of age born in 2019 in the VetCompass programme in the UK. *CI = Confidence Interval, n=232,056.

Variable	Category	Odds Ratio	*95% CI	Category P-value	Variable P-value
Breed	Crossbreed	Base	--	--	<0.001
	Parson Russell Terrier	13.46	4.17 - 43.49	<0.001	--
	Dorset Olde Tyme Bulldogge	8.60	2.08 - 35.53	0.003	--
	Border Terrier	6.53	3.32 - 12.87	<0.001	--
	West Highland White Terrier	4.96	2.13 - 11.57	<0.001	--
	Staffordshire Bull Terrier	3.92	2.51 - 6.12	<0.001	--
	French Bulldog	3.00	2.05 - 4.37	<0.001	--
	Jack Russell Terrier	2.10	1.15 - 3.86	0.016	--
Sex	Female	Base	--	--	
	Male	1.49	1.16 - 1.93	0.002	0.009

Clinical data:

- Jumping** (n=58, 23.29%) and **falling from a height** (n=49, 19.68%) were the most commonly reported inciting events

- Radiography** assisted diagnosis in 236/249 (94.78%) cases

- Surgery** was performed in 155 (62.25%) cases with Kirschner wires and tension bands (n=70, 28.11%) as the most common method of surgical fixation



Fig. 3 (Left): Post-operative radiograph of tibial tuberosity avulsion fracture after internal fixation with K-wire and tension band. (Right): Pre-operative radiograph of tibial tuberosity avulsion fracture © Carlos Sanchez Villamil

Risk factor analysis:

Muscular breeds showed 4.23 times the odds of tibial tuberosity fracture compared with non-muscular breeds (95% CI 3.10-5.78, $P<0.001$).

Male dogs demonstrated increased odds of tibial tuberosity fractures compared with females (OR 1.49, 95% CI 1.16-1.93, $P=0.002$).

Conclusions

Radiography was used to confirm the diagnosis for almost all cases and should be considered in high-risk breeds under one year presenting with clinical signs of hindlimb lameness.

Increased muscle mass may be involved in the aetiopathogenesis of tibial tuberosity fractures due to involvement of quadriceps contraction with stifle extension and increased forces acting upon the patellar tendon attaching to the tibial tuberosity.

Male sex as a risk factor may support findings relating to breed muscularity because males generally have increased muscularity and excitability compared to females¹².

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