

PELVIMETRY TO DIAGNOSE DYSTOCIA IN THE BITCH

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Dystocia in the bitch is a common cause for veterinary consultation. The frequency of dystocia in the dog population is unknown, but is probably <5%, although in some breeds this figure may be as high as 50-100%. Underlying causes, congenital or aquired, are still little investigated.

Pelvimetry means measuring of distances and angles between structures of the pelvis (Fig.1) and can be done by palpation, or on x-rays of the pelvis. Radiologic pelvimetry is used routinely in women. The technique has also been used in cows and sheep. Pelvimetry has been considered not applicable in the dog due to the great variation in size, and because the number of fetuses and their size also varies in this species. We wanted to find out if pelvimetry could be used to diagnose obstructive dystocia in three breeds known for a high frequency of difficult births: Boston Terriers, French Bulldogs, and Scottish Terriers.

The study consists of three parts: 1) a pelvimetric study, with a comparison of the pelvic measurements in normally whelping bitches and in bitches experiencing obstructive dystocia, 2) collection of litter data on the size and number of pups to evaluate the importance of these parameters for the development of dystocia, and 3) a study on the inheritance of the shape and size of the pelvis. The last study was done in the Boston Terrier breed.

A total of 88 Boston Terriers (55 bitches and 33 males), 26 Scottish Terriers (18 bitches and 8 males) and 16 French Bulldogs (all bitches) were included in these studies.

Materials and methods.

The importance of the pelvic shape for the outcome of the whelping

Twenty Boston Terrier, 14 Scottish Terrier and 11 French Bulldog bitches with an unambiguous whelping history of obstructive dystocia were included in the study. Based on the history bitches were divided in two groups, free-whelping bitches and bitches with obstructive dystocia leading to caesarian section. The bitches were examined clinically and weighed, and radiographs were taken in ventrodorsal and lateral projections. Measurements were also taken of the circumference, height and width of the bitch's head, body length, height at withers and the distance between some palpable structures of the pelvis. Bitches were not examined when they were in oestrus or pregnant, or if they had whelped less than 60 days previously. They were not sedated. A number of measurements were made on the radiographs (Fig.1)

Radiographic examination

Radiographs of the pelvis and caudal half of the lumbar spine were taken in left lateral and dorsal recumbency. The focus film distance was 90 cm and in order to minimize the object-film distance and thereby magnification, no grid was used. Great care was taken to have the dog in a perfectly straight position on the table, in order to obtain a symmetrical radiograph of the pelvis. Correction for magnification of the pelvis on the radiograph was considered unnecessary after investigation. Measurements of distances and angles of the pelvis were made with a ruler on the radiographs (the level of accuracy was 0.5 mm) (Eneroth et al., 1999).

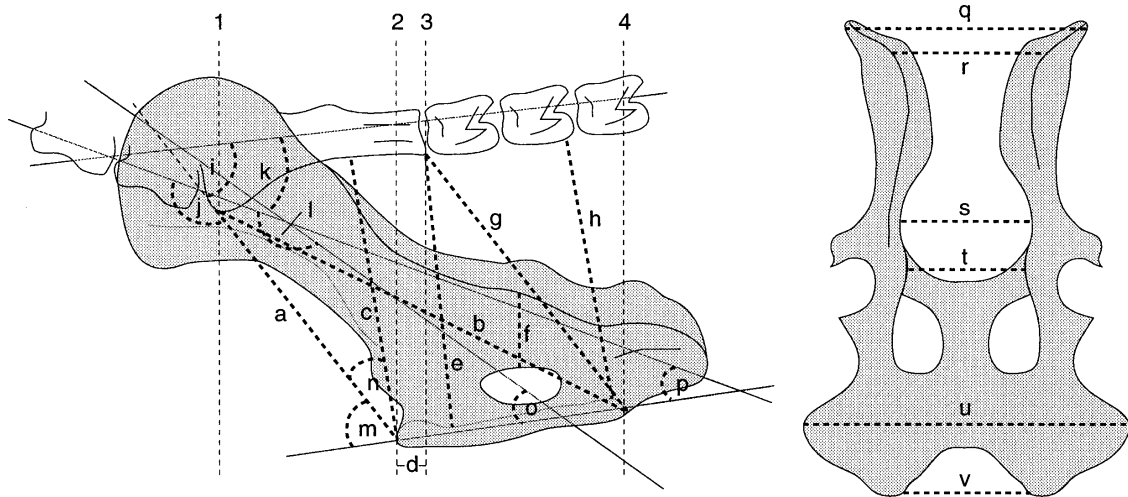


Fig. 1. Distances and angles between structures of the pelvis that were measured in the bitches.

Importance of the pups for the outcome of the whelping.

Information on litter size, pup weight and course of the whelping was gathered. Pups were weighed and measured for width, height and circumference of the head, width over shoulders, and body length immediately after birth. A total of 59 litters (196 pups) of Boston Terriers, 32 litters (131 pups) of French Bulldogs, and 22 litters (84 pups) of Scottish Terriers were included. The relation between the weight and body measurements of each pup was calculated.

Inheritance of pelvic shape

As a further step we also wanted to investigate whether pelvic shape was inherited. For this purpose Boston Terrier stud dogs and offspring over 12 months of age were examined in the same way as the bitches. Forty-three offspring from 19 different pairs of parents were examined. The pelvic conformation of the offspring was compared to the combined mean measurements of the two parent dogs.

Statistical calculations: All comparisons were made within breed. (For details see Eneroth et al., 1999).

Results.

Pelvic shape.

Boston Terriers

In the Boston Terriers it was the relation between the height of the pelvic canal and the distance between the tubera ischii (c/u in Fig.1) which discriminated between free-whelping bitches and bitches with dystocia ($p < 0.05$; Table 1; Fig.2). Litter size was not different in the free-whelping bitches compared to in those with dystocia (Table 2). The size of the pups had a large influence on the outcome of the whelping (Table 2).

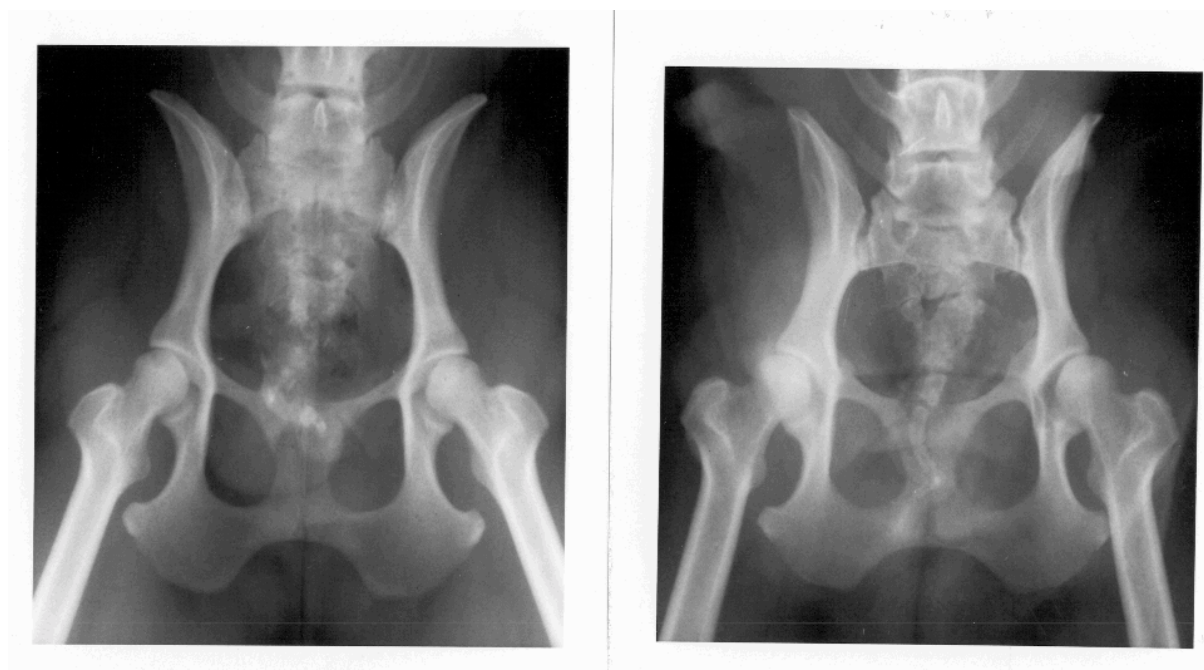


Fig. 2. The x-ray to the left shows the pelvis of a free-whelping Boston Terrier bitch and the right one is from one with obstructive dystocia. Note the more rounded pelvic opening in the left figure and the flattened opening in the right figure.

Distance measured (cm)	P-value Boston Terriers n=20	P-value French Bulldogs n=11	P-value Scottish Terriers n=14
a) Conjugata vera	P = 0.550	P = 0.950	P = 0.021
b) Conjugata diagonalis	P = 0.730	P = 0.620	P = 0.005
c) Diameter verticalis	P = 0.130	P = 0.230	P = 0.017
e) Sacral diameter	-	-	P = 0.028
g) Sagittal diameter	-	-	P = 0.002
q) Widht between tubera coxae	P = 0.580	P = 0.800	P = 0.042
s) Diameter transversa	P = 0.850	P = 0.088	P = 0.930
t) Width between acetabuli	P = 0.680	P = 0.160	P = 0.520
u) Width between ischiadic tubera	P = 0.860	P = 0.180	-
c/u (Height/width relation)	P = 0.042	P = 0.820	P = 0.007
c/s (Height/width relation)	P = 0.050	P = 0.450	P = 0.018

Table 1. P-values for the difference in pelvic measurements from radiographs of normally whelping bitches and bitches with obstructive dystocia of the three breeds. (n= number of bitches).

French Bulldogs

The body size and weight were different between the two groups of bitches. There was a tendency for the bitches with dystocia to have a more narrow pelvic canal (measures s and t in Fig.1) while there was no difference in the height of the pelvic canal (Fig. 3). Litter size was larger in the free-whelping bitches, while the pup weight in relation to the weight of the bitch was larger in the bitches with dystocia (Table 2). The size of the pup had a large influence on the outcome of the whelping.



Fig. 3. In the French Bulldog bitches no significant differences were found in pelvic measurements between free-whelping bitches and bitches with obstructive dystocia.

	Mean pup weight (gram)		Mean pup weight (% of dam's)	
	Free-whelping bitches	Bitches with dystocia	Free-whelping bitches	Bitches with dystocia
Boston Terrier	185 ^a	205 ^b	2.5 ^c	2.8 ^d
French Bulldog	241	266	2.1 ^c	2.7 ^d
Scottish Terrier	214	221	2.1 ^a	2.5 ^b

Table 2. Different superscript letters within a row and parameter (within breed) means significant difference between groups. ^{a,b}($p < 0.001$), ^{c,d}($p < 0.05$).

Scottish Terriers

The free-whelping bitches were larger and heavier than the bitches with dystocia and there was a strong relation between the height of the pelvic canal and the size of the bitch (height at withers, body weight and body length). All the height measures of the pelvic canal and also its length were significantly smaller in the bitches with dystocia ($p < 0.05$)(Table 1). It was the combination of 3 pelvic measurements, (*g*), *the angle (k)* and *the relation (g/t)*, which discriminated the two groups of bitches (see Fig.1; Fig 4).

The pups did not differ between groups in absolute weight but when measured as percent weight of that of the bitch the pups in the dystocia group were significantly heavier (Table 2). Litters were significantly larger in the free-whelping group.



Fig. 4. The x-ray to the left shows the pelvis from a free-whelping Scottish Terrier bitch while the one to the right is from one with obstructive dystocia. Note the more rounded pelvic inlet in the x-ray to the left and the more flattened shape in the x-ray to the right.

There was a significant difference in pelvic shape between free-whelping bitches and the group with dystocia, with a flattened and shortened pelvis in the latter group. Pup weight did not differ in grams, but in percentage of the mother's weight. Thus, it was the smaller size of the bitches with dystocia, not that pups were larger, that caused the problems.

The importance of the pups for the outcome of the whelping.

Breed	Number of litters	Number of pups	Litter size (means)	Pup weight (gram)	Pup weight (%)
Boston Terrier	58	226	4.05	200	2.7
French Bulldog	59	252	4.61	234	2.2
Skottish Terrier	27	105	4.22	219	2.3

Table 3. Information about litters and pups

Boston Terriers

See Table 3. There was a significant relation between litter size and the mean weight of the pups, with heavier pups in the smaller litters. Pups from c-sectioned litters were significantly heavier than the free-born pups. It was especially the circumference of the head of the Boston Terrier pups which increased with increasing weight and consequently the heavier pups are prone to cause obstructions. The relation between the height of the pelvic canal (c) and the height of the pup's head was significantly different between groups. In the c-sectioned bitches the pups' heads were seen to be larger than the height of the pelvic canal.

French Bulldogs

See Table 3. Mean litter size was significantly larger in the naturally born litters (4.97 pups) compared to in the c-sectioned litters (3.95 pups). Also in the French Bulldogs there was a relation between small litter size and mean higher pup weight, and vice versa. Pup weight differed, but not significantly, between groups. However, the pup's weight in relation to the weight of the bitch was considerably higher in the group of pups from c-sectioned litters. The body measurements of these pups were also larger, except body length. Especially the circumference of the head and body, and the width over the shoulders increased with increasing pup weight.

Scottish Terriers

See Table 3. Mean litter size was 4.22 pups. Litter size was different in free-whelped litters (4.79 pups) compared to in c-sectioned litters (3.62 pups) and the pups from c-sectioned litters were also significantly heavier (230g) than those from the naturally born litters (213g), but there was no significant relation between small litters and heavy pups. Heavier pups were larger all over, except for body length.

Inheritance of pelvic shape.

We found a strong tendency that the pelvic shape in Boston Terriers is inherited from both the father and the mother in that 26 % of the pelvic shape in the offspring could be explained by the pelvic shape of the parents. (Fig. 5).

There were differences in pelvic shape between the sexes. The pelves of the male dogs were generally wider and longer, but with a more narrow pelvic canal than the pelves of the bitches.

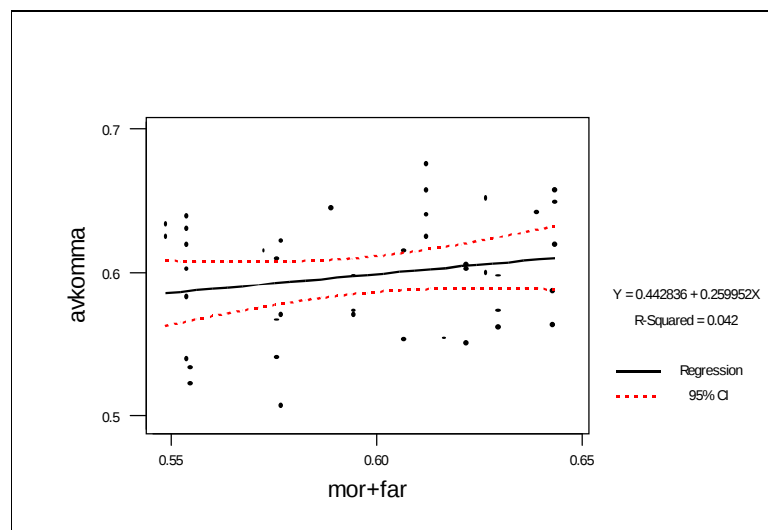


Figure 2. Regression curve testing the pelvic shape of the offspring (y-axis) against the mean values of the pelvic shape of the parents (x-axis). The dotted lines show the confidence interval (95%).

Conclusions

Pelvimetry was found to be a technique which can be useful also in dogs. In this study the relation between height and width of the pelvic canal was smaller in bitches (Boston Terriers

and Scottish Terriers) with obstructive dystocia. It should, thus, be possible to estimate whether a bitch is likely to free-whelp or to suffer from obstructive dystocia by making x-rays of the pelvis and taking the various measurements of the pelvis. However, the shape of the pelvis varies between breeds and before pelvimetry can become generally useful in clinical practice more bitches of various breeds need to have the measurements and angles determined and an index for each breed should be calculated

The finding that the shape of the pelvis is inherited makes it possible to advice the breeders how to breed based on x-rays of the pelvises of the dogs and bitches, and to choose animals with good pelvic shapes, and to avoid to mate two dogs which both have a poor pelvic shape.

It has previously been stated that dystocia occurs when the weight of a pup is 4-5% or more of that of the bitch. In our study, however, dystocia occurred already at whelp weights of 2.8 % (Boston Terrier), 2.7% (French Bulldog), and 2.5% (Scottish Terrier) of the weight of the mothers, respectively. In Boston Terriers and French Bulldogs there was a significant negative relation between litter size and average pup weight, while no such relation was found in Scottish Terriers.

Reference:

Eneroth A, Linde-Forsberg C, Uhlhorn M, Hall M: Radiographic pelvimetry for assessment of dystocia in bitches: a clinical study in two terrier breeds. J Small Anim Pract (1999) 40, 257-264.