HEMIVERTEBRAE
by
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About the Author

Consider the Ideal Frenchie! Ah, that zenith of canine loveliness, with its beautiful flat face, roach back, hunk-like body, screw tail, voluminous wrinkles! But as with all purebred dogs, the distinguishing features of our little furry friends are not without cost, as they carry with them an increased risk of medical problems.

Frenchie breeders and pet Frenchie owners alike should be informed about some of the common problems seen in their breed. Informed breeders may help minimize the incidence of the more predictable inherited problems, to keep them from becoming the nightmare that conditions like hip dysplasia and juvenile cataracts have been for other breeds. For that reason, this article will deal with a common problem in Frenchies: hemivertebrae.

Two distinct problems which are seen alarmingly often in *brachycephalic (short faced)*, screw tailed breeds (French and English Bulldogs, Boston Terriers) affect the back. These are : congenital malformations of the vertebrae, and degenerative disc disease. In this issue, we shall consider the commonest clinically-significant vertebral malformations (hemivertebrae), and in the next issue, disc disease. Forwarned is forarmed (or forpawed).

Canine backs normally have from 49 to 53 vertebrae, depending on tail length. Our abbreviated little screw tailed friends thus have about 10 to 15 fewer, the missing bones being those of the errant tail.Those tail vertebrae that are present are usually deformed in Frenchies. The bones of the back, while all having the same basic structure, are differentiated into various regions, with 7 Cervical, 12 or 13 Thoracic, 7 Lumbar, 3 Sacral, and the rest Coccygeal vertebrae. (Fig. 1).

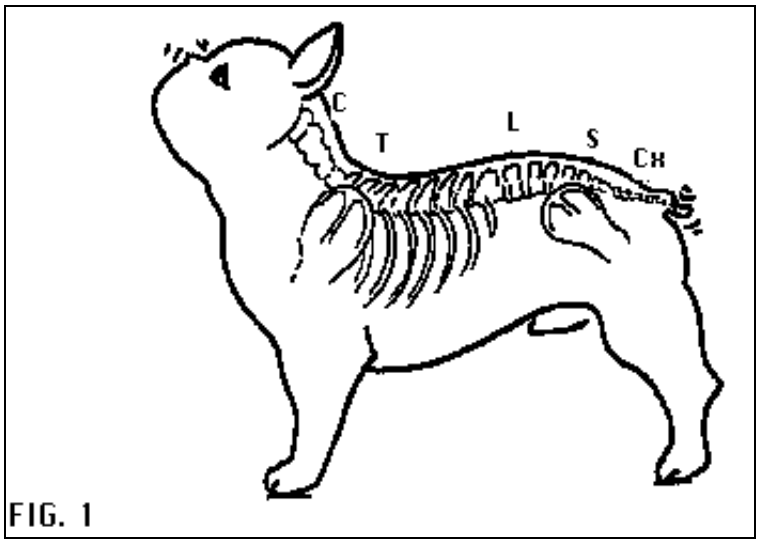
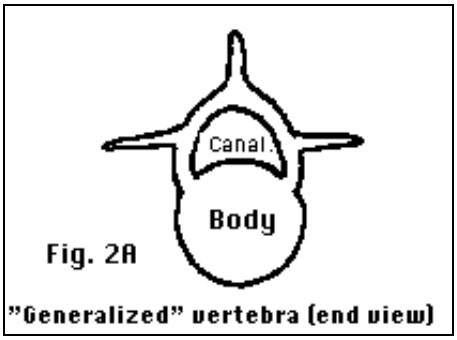


FIG. 1

Each vertebra in that elegant Frenchie top-line has a cylindrical ventral part (the body), between adjacent pairs of which are the intervertebral discs.The alternating bodies and discs form a flexible supporting rod. A body arch rises dorsally from each body to enclose an opening (spinal foramen). (Fig. 2).



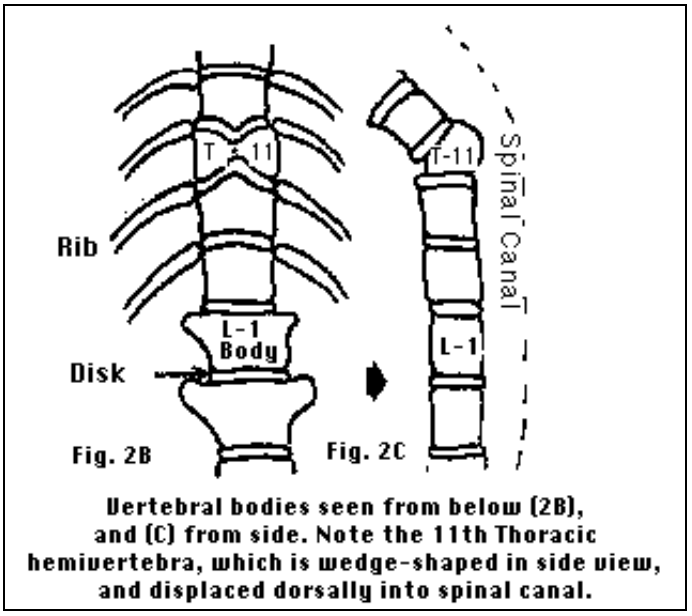
"Generalized" vertebra (end view)

The large number of vertebrae, coupled with the complex development of each from several bone-forming centers, predispose the back to a high probability of errors. Many defects represent an incomplete development, as seen in hemivertebrae *("butterfly" vertebrae)*. This is a CONGENITAL defect (present at birth) with a GENETIC (inheritable) basis, though it is unlikely that the genetic mechanism is a simple one-locus, dominant/recessive one. The very high incidence of hemivertebrae in brachycephalic, screwtailed breeds is a reflection of the fact that the brachycephaly and short tail are actually skeletal deformities (sorry, Minnie!) which have been built into the breed. Beautiful to the eye, but malformations nevertheless. In fact, the coccygeal vertebrae in the screwtail ARE hemivertebrae, whose asymmetry produce that elegant little embellishment on the derriere.
But what is esthetically pleasing on the rump may have serious consequences in the rest of the spine.

Hemivertebrae form when the right and the left halves of the developing vertebral body fail to fuse, producing a body which ressembles a butterfly when seen from above. The two unfused halves often grow unequally, producing a wedge-shaped vertical body. Depending on which way the broad side of the wedge is directed, this may cause a dorsal curvature *(kyphosis)* or a lateral curvature *(scoliosis)*.As the backbone is bent, so bends the spinal canal; and any deformity of the canal can compress the spinal cord and/or its blood supply, with serious effects.

If the function of the spinal cord is impaired by direct compression or by vascular problems, the animal may show either pain or loss of sensation due to the interruption of the sensory circuits; if motor nerve circuits in the cord are affected, weakness or paralysis, especially of the hind limbs, will result. Any body part receiving its nerve supply from that part of the cord posterior to the damaged area may be affected.

Various studies have reported on several aspects of hemivertebrae in dogs. The vertebrae most often involved are the 9th thru the 11th Thoracic vertebrae; secondary changes in the rib cage may be produced by a curvature here.
There are many cases, often involving only a single vertebra, in which no clinical problems are seen, and the malformation may be detected only accidentally, if at all. If more than one vertebra is involved, the probability of clinical problems increases due to the greater degree of curvature.



Vertebral bodies seen from below (2B), and (C) from side. Note the 11th Thoracic hemivertebra, which is wedge-shaped in side view, and displaced dorsally into spinal canal.

In those rare cases in which the dog *does* show some clinical signs, the outlook is not good. Most often, symptoms begin at the age of three or four months, with a sudden onset of hindlimb weakness, often preceded by a gait abnormality which is often noted only in retrospect. There may be pain on palpation of the back at the level of the hemivertebrae, with varying degrees of curvature. The latter may be so subtle that it is only detectable radiographically. In pups which do show such symptoms, the hindlimb paralysis generally worsens, the muscles waste, and bladder and bowel control may be lost. In most cases, that awful decision to euthanize must eventually be faced.

Hemivertebrae, both the wedge-shaped and butterfly-shaped types, are very common in Frenchies, and when a single one is present it very rarely causes problems. The inheritability of hemivertebrae in minks is by an autosomal recessive gene. In humans, it is known to be familial (i.e. to "run in families"), but it is not inherited in a straightforward and predictable way. In Frenchies, hemivertebrae appear to be so common that they may be an unavoidable side effect of the chondrodystrophic condition that characterizes the breed.

Chondrodystrophy (derived from words meaning "bad cartilage nourishment") is a condition in which the fetal skeleton, which is first formed in cartilage as a sort of "model ", does not have a good blood supply, and so doesn't develop properly. This results in the bones that replace the early cartilage models being poorly formed. (This poor nourishment of cartilage also causes the cartilage of the intervertebral discs to deteriorate early in life, often leading to intervertebral disc degeneration and herniation as the next article will describe).
The long bones of the limbs are malformed by chondrodystrophy in a way that causes a flaring of the ends of the bones; this is what Frenchie people prize as "bone", actually a malformation and an indicator of the degree of the chondrodystrophy. In the spine, chondrodystrophy increases the incidence of malformed vertebrae. The more

severe the chondrodystrophy, the greater the incidence of malformations.

It is unfortunate that we have no accurate data on the true frequency of hemivertebrae in our breed, and we do not know whether they tend to be more common in some lines of dogs than in others. We need to do X-ray screening of whole families of dogs, and follow them through several generations, to determine this. Since most hemivertebrae are detected incidentally on X-rays being done for other reasons, it is clear that they are usually asymptomatic.

Most back problems in Frenchies are caused by degenerative disc disease. Because of this, it is difficult to know how to decide whether to breed a dog with hemivertebrae. If a bitch has more than one, or if she has any sign of spiral canal deformity, instability, or muscle weakness and/or pain related to hemivertebrae, she shouldn't be bred because of the additional stress that pregnancy would place on her back. If a dog or bitch has several hemivertebrae, or has produced puppies with multiple hemivertebrae and/or symptomatic back problems, it probably shouldn't be bred. But if an animal with only a single hemivertebra and no clinical problems related to it is otherwise sound, and possesses desirable traits that should be perpetuated, then breeding it (especially to another Frenchie with a good and asymptomatic back) might be all right.

If a breeder can find a vet who cares for a number of Frenchies (and other breeds affected by hemivertebrae, like Pugs, Bulldogs and Boston Terriers), that vet could help evaluate backs of potential breeding animals both radiologically and by physical exam, and could help advise the breeder about pros and cons of breeding a given animal.
A vet involved in this way could also help gather the type of information we need in order to learn more about this condition and whether we can by selective breeding lessen its incidence in French Bulldogs.
As with most genetic issues, the primary need is for concerned breeders to be diligent in their analysis of their dogs, and honest and open in the sharing of information about them. Anyone who loves our breed (and who could help it?) should be alert to its potential problems, especially those which may be debilitating and/or life-threatening. The best conformation in the world is futile if the dog dies young; and the grief resulting from the loss of a beloved pet is beyond price. Every Frenchie is a precious gift, and we should do what we can to give them the best and longest lives possible.

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