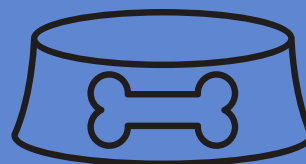
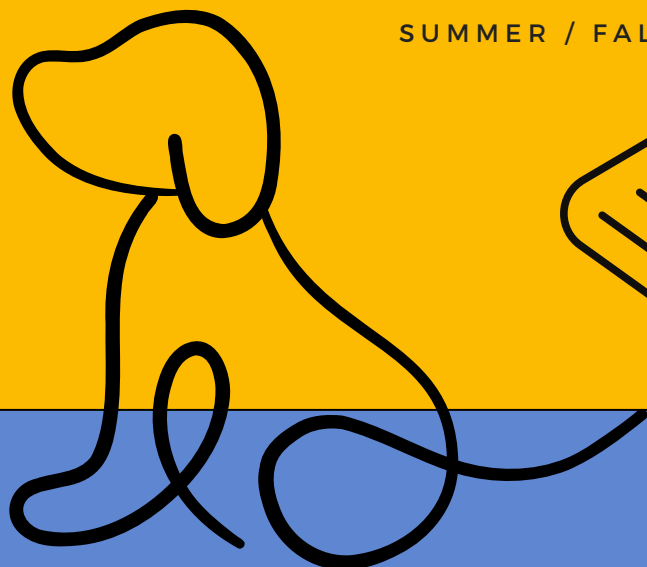


Four Leg News

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Transitional Vertebra

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Let's journey through the years to see what we can learn in the literature about lumbosacral transitional vertebra. What are they? What do they look like on X-ray? Classifications. What is the prevalence of transitional vertebra? What correlations can be made with cauda equina syndrome and with canine hip dysplasia?

This was honestly a fascinating learning journey for me... and helps to explain what I find and feel in some of my patients where I know or suspect they have a lumbar transitional vertebra!

Enjoy the read!



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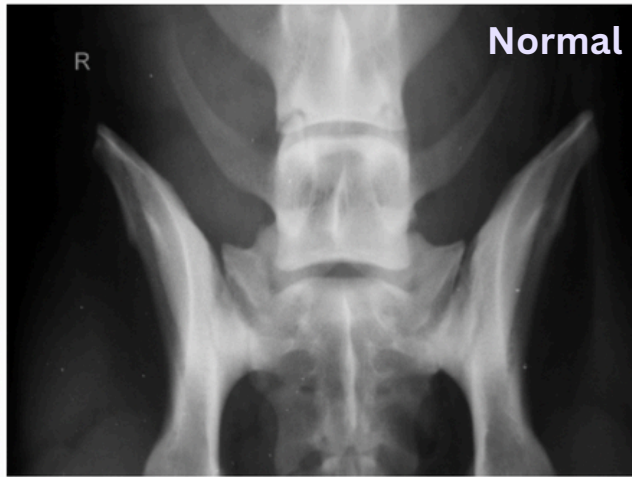


FIG. 1. Ventrordorsal projection of the lumbosacral area in a normal dog with the pelvic limbs extended. The last lumbar vertebra is correctly formed and oriented. Its transverse processes have a regular shape, are not in contact with the ilia, and are pointing in the craniolateral direction. The three spinous processes of the sacral vertebrae are fused forming the median sacral crest. The orientation of the vertebrae is straight. There is a minimal difference in the length of the sacroiliac attachments.

Damur-Djuric N et al 2006

It may lead to degeneration of the lumbosacral junction and cauda equina syndrome, particularly in German shepherd dogs. It has been thought that TLSV can predispose dogs to cauda equina syndrome and hip dysplasia.

“If you don’t own a dog, at least one, there is not necessarily anything wrong with you, but there may be something wrong with your life.”

– Roger A. Caras

What is a transitional lumbosacral vertebra?

Lumbosacral transitional vertebra (LTV) is a congenital and hereditary condition seen in many dog breeds. A lumbosacral transitional vertebra (LTV) is an abnormal vertebra found between the last lumbar vertebra and the first sacral vertebra. It is thought to be congenital with characteristics of lumbar and sacral vertebra. Morphology of the transverse processes and vertebral body characterizes the type of LTV, which may be symmetric or asymmetric, and the variations in length of the sacroiliac attachment.

Morphological findings on the radiographs

- Spinous process of the first sacral vertebra separated from the medial sacral crest
- Incomplete formation of the disc cranial to the sacrum (narrowing of disc space)
- Variation in transverse processes of the pre-sacral vertebra,
- Asymmetric formation of the transverse processes of the pre-sacral vertebra,
- Contact between the ilium and the transverse processes of the pre-sacral vertebra,

Morphological findings on the radiographs

- Rotation of the pre-sacral vertebra over its vertical axis,
- Rotation of the sacrum over its vertical axis, or
- Variations in the length or position of the sacroiliac attachment.

Types of transitional lumbosacral vertebra

The types of an LTV were categorized according to the attachment of the transverse processes to the ilium.

- **Type 1** is lumbar with no attachment to the sacrum or ilium (lumbarization of S1).
- **Type 2** is intermediate, with the base partially attached to the ilium and the sacrum, and an unattached tip. Symmetrical attachment with intervertebral space.
- **Type 3** is sacral, with a broad attachment to the ilium and wing of the sacrum. Asymmetrical attachment.

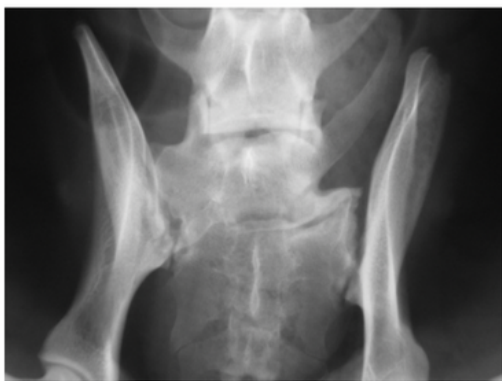


FIG. 4. Ventrordorsal projection of the lumbosacral area in a dog with the pelvic limbs abducted. There is an asymmetric lumbosacral transitional vertebra, which is slightly rotated to the right. The transverse process on the left is normal (type 1), while the one on the right is fully attached to the ilium and sacrum. There is no free tip (type 3). The sacrum has only two fused spinous processes. The presacral intervertebral disc space is narrow and uneven in width. The sacroiliac attachment is longer on the left side but the total attachment between the spine and the ilium is longer on the right side.

Damur-Djuric N et al 2006



FIG. 2. Ventrordorsal projection of the lumbosacral area in a dog with the pelvic limbs extended. There is an asymmetric lumbosacral transitional vertebra. The transverse process on the right is short, but not in contact with the ilium (type 1), while the one on the left is broad based, pointing in the lateral direction and has partial contact with the ilium (type 2). Only two fused spinous processes of the sacral vertebrae are visible, suggesting that the sacrum consists of only two vertebrae. The right sacroiliac attachment is longer than the left one.

Damur-Djuric N et al 2006

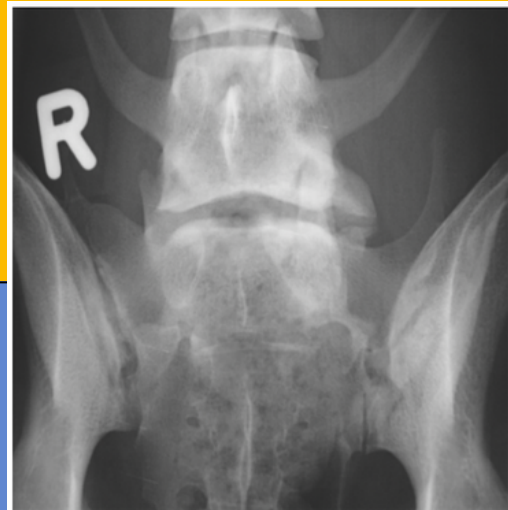
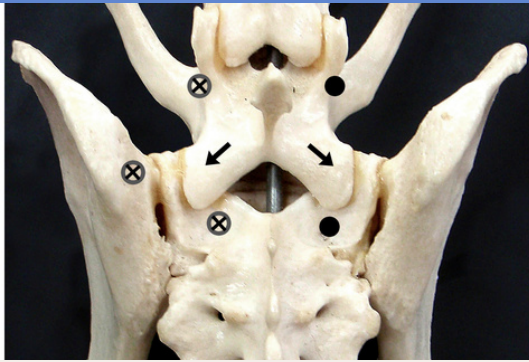


FIG. 3. Ventrordorsal projection of the lumbosacral area in a dog with the pelvic limbs abducted. There is a symmetric lumbosacral transitional vertebra. Both transverse processes are broad based and have partial contact with the ilia, while their tips remain free (type 2). The length of the sacroiliac attachment is identical on both sides, but the one on the left side is slightly more caudal than the one on the right side. Spondylotic osteophytes are noted between the last true lumbar and the transitional vertebra.

Damur-Djuric N et al 2006

“The great pleasure of a dog is that you may make a fool of yourself with him and not only will he not scold you, but he will make a fool of himself too.” – Samuel Butler



From: <https://peerj.com/article/1094/>



Breit et al 2003

Prevalence

5 ARTICLES STOOD OUT REGARDING PREVALANCE

1. **Morgan 1999**
2. **Breit et al 2003**
3. **Damur-Djuric et al 2006**
4. **Berg et al 2024**
5. **Lappalainen et al 2012**

1. A 20-year accumulation of lumbo-pelvic x-rays were accumulated & studied.

- 143 dogs: 82 males and 61 females
- Frequency of the anomaly within the total population was 2.5%
- Frequency of affected German shepherd dogs was higher (44%)

2. 145 (130 adult, 15 juvenile) randomly selected radiographs of the pelvis was examined.

- 25 out of 145 dogs had lumbosacral transitional vertebrae.
- 9.7% were symmetric and 9.7% were asymmetric.
- German shepherd dogs and Golden Retrievers were more affected than Rottweilers.

3. Pelvic radiographs of 4000 (45.3 % male, 54.7% female) dogs that were screened for hip dysplasia, consisting of 144 medium to large breeds, were reviewed.

- 138 (3.5%) dogs had an LTV, 66 were male and 72 were female.
- Greater prevalence in German Shepherd dogs and Greater Swiss Mountain dogs. Shar-Pei dogs had a prevalence of 19%.

4. Ventrodorsal radiographs from the CHD screening program undertaken by the Norwegian Kennel Club were evaluated.

- A total of 13,950 (54.7% female, 45.7% male) dogs were included in the study.
- The overall occurrence of LTV was 18.5%, of which 32.9% were type 1, 45.7% were type 2 and 21.4% were type 3.

5. A radiographic study of 228 German Shepherd dogs (79 male, 149 female)

- 92 (40%) dogs had a LTV
- The most common type being separation of first spinous process from the median crest of the sacrum in 62 dogs (67% of LTV).



Other Fascinating Findings!

LET'S TALK CAUDAL (COCCYGEAL) VERTEBRAE

Morgan 1999 found:

- In 60.8% of cases, the sacrum had three fused segments, with the first coccygeal segment fused to the sacrum.
- In 39.2 % of cases, the sacrum had only two fused segments, with the first coccygeal segment being separated.

Moeser and Wade (2017) conducted a radiographic study of dogs in a breeding colony of Labrador Retrievers and Labrador x Golden Retrievers. They found:

- 119 puppies from 18 litters were included, of which 69 had normal conformation, 9 had 8LV, 9 had transitional L-SV and 32 had fusion of the first caudal vertebra (Ca1) to the caudal sacral segment or a reduced joint space in this area.

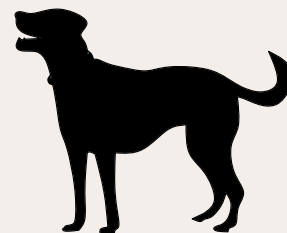
CAUDAL (COCCYGEAL) VERTEBRAE CONTINUED...

- Compared with the population as a whole, significantly more progeny were observed to have abnormalities of the sacral region when both parents were affected by either fusion of Ca1 to the third sacral vertebra (S3) and/or had 8LV.
- There were not enough animals to perform a heritability analysis, but there were strong similarities between progeny and parental phenotypes, suggesting high heritability.

LET'S TALK SACROILIAC JOINT LIGAMENTS

Damur-Djuric et al (2006) noted:

- In 82% of the dogs with a symmetric LTV, the lengths of the sacroiliac attachments were similar on both sides. In 50% of the dogs with an asymmetric LTV, the lengths were similar on both sides. When the lengths were unequal, the shorter sacroiliac attachment was on the side where the transverse process had a longer contact zone with the pelvis.



Other Fascinating Findings!

LET'S TALK ROTATIONS OF THE TRANSITIONAL VERTEBRA AND OF THE SACRUM

Damur-Djuric et al (2006) noted:

- In 15% of the symmetric LTV, there was rotation; while in 29% of asymmetric LTV there was rotation. Of the rotated asymmetric LTV, 85% were rotated towards the transverse process that had a longer contact zone with the pelvis.
- The sacrum was rotated in 19% of the symmetric and in 46% of the asymmetric LTV.; more often towards the shorter contact zone between the transverse process and sacrum.

LET'S TALK LUMBAR TRANSITIONAL VERTEBRA & HIP DYSPLASIA

Morgan (1999) reported:

- Several of the dogs with LTV also had hip dysplasia. If the pelvic attachment caused rotation (40.6%) it resulted in asymmetrical dysplasia (22.4%), with the acetabula position altered.

Berg et al 2024 looked at LTV and it's association with hip dysplasia:

- Results indicate that LTV type 2 and type 3 are associated with mild and severe canine hip dysplasia.

**"I just want to be in my sweats, walk my dog, watch TV and eat pizza."
– America Ferrera**

Berg et al 2024 continued...

- CHD grades were classified as CHD free (CHD=A, B), CHD mild (CHD=C), and CHD severe (CHD=D, E).
- The frequencies of CHD grades were A: 43.1%; B: 31.4%; C: 18.4%; D: 6.0%; E: 1.1%.

LET'S TALK LUMBAR TRANSITIONAL VERTEBRA & CAUDA EQUINA SYNDROME

Flückiger et al 2006 reviewed medical records of dogs diagnosed with cauda equina syndrome (CES)

- 92 dogs were identified with CES, and 40% were German shepherds.
- The control group of 4000 dogs represented 143 breeds, and 17.1% were German shepherd dogs.
- In the CES group, 15 dogs had an LTV while 3.5% had an LTV in the control group.
- The CES group had a lower ratio of German shepherd dogs with LTV to the ratio of other breeds as compared to the control group, so it appears that LTV is a stronger determinant for the development of CES rather than the breed.
- In the CES group, those with LTV were affected earlier than those without LTV.

Clinical Take Aways

1. There are 3 types of lumbar transitional vertebra - All would classify as lumbarization of S1
2. Prevalence = 2.5% to 18.5%, but up to 40% in German Shepherds!
3. Dogs with LTV will often have a sacralized first coccygeal vertebra
4. Lumbar transitional vertebra can correlate with hip dysplasia and cauda equina syndrome.
5. I personally think, you might palpate abnormalities at the SIJ, L7/L8/Sacrum... so keep LTV in mind if you do!



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“EVERYONE THINKS THEY
HAVE THE BEST DOG, AND
NONE OF THEM ARE
WRONG.”

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