

# RADIOGRAPHIC APPEARANCE OF EQUINE LUMBOSACRAL AND PELVIC ABNORMALITIES BY LINEAR TOMOGRAPHY

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Radiologic findings are described in 20 horses with clinical signs of a caudal lumbar or hindlimb problem; the horses were subjected to linear tomography of the lumbosacral and pelvic regions. The cases could be divided into four groups: sacroiliac arthrosis (6 horses), lumbosacral abnormalities (3 horses), pelvic or lumbar fracture (6 horses), and no radiographic abnormalities (5 horses). Five of the six horses with sacroiliac arthrosis had spur formation, with localized arthrosis at the caudal aspect of the sacral wing and its articulation with the auricular surface of the ilium. In one horse these lesions were confirmed at postmortem examination. The sixth horse, a Standardbred trotter, had more even and widespread arthrosis of the sacroiliac joint. The three lumbosacral abnormalities were present in two horses with fusion of the L<sub>5</sub>-L<sub>6</sub> articulation and one horse with a wider than normal sacrolumbar articulation. Linear tomography also proved to be of diagnostic and prognostic value in the evaluation of lumbar and pelvic fractures. Finally, tomography could be used to eliminate the presence of sacroiliac or lumbosacral damage in some horses that presented with clinical signs suggestive of disease of the lumbosacral or sacroiliac region. *Veterinary Radiology*, Vol. 24, No. 5, 1983; pp 201-213.

**Key words:** radiography, tomography, x-ray, linear tomography, sacroiliac joint, lumbosacral region, pelvic bones, horses.

THE RANGE OF CLINICAL CONDITIONS affecting the lumbosacral and pelvic regions of the horse is extensive.<sup>1</sup> From a radiologic point of view, pelvic fracture is the most important entity,<sup>2</sup> and osteoarthritis of the hip (*i.e.*, coxitis) is rare.<sup>3</sup> There seems to be an increasing awareness of lesions affecting the sacroiliac region in Thoroughbreds<sup>4,5</sup> and Standardbreds.<sup>6,7</sup> However, definitive diagnosis in many horses is not possible, and only a clinical opinion based on subjective experience can be given for the cause of lameness. The inherent difficulties of survey radiography of the lumbosacral region have been considered previously,<sup>3,8</sup> but principally they involve the considerable thickness of the quarters of the horse, the limited projections possible in this region, and the superimposition on skeletal structures by large bowel.

The present paper reports the potential value of linear tomography as an additional diagnostic aid in a series of horses with lameness, back pain, or loss of performance.

## Materials and Methods

A total of 20 horses of varying ages and types was referred to the Department of Clinical Radiology (Table 1). The case histories were assessed, and the appropriate clinical and radiographic investigations leading to a tentative or presumptive diagnosis of lumbosacral or pelvic injury were performed. Radiographic evaluation in the ventrodorsal projection, including linear tomography of the lumbar, lumbosacral, or pelvic regions, was then performed. The technique of tomography, including the method of general anesthesia, was previously described.<sup>8</sup> A series of three or more tomograms was taken at approximately 10-mm intervals through the area of the suspected abnormality.

## Results

The cases were grouped according to the anatomic region concerned and the type of radiographic changes demonstrated. Radiographic findings with potential clinical significance were recorded in 15 of the horses (75%) investigated.

### *Sacroiliac Arthrosis*

The most frequent single entity diagnosed was sacroiliac arthrosis, which was found in six horses (30%). The clinical history in these horses was poor

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TABLE 1. Clinical Details of 20 Horses Referred for Linear Tomography of the Lumbar, Sacral, and Pelvic Regions

Category	Horse No.	Age (yrs)	Sex*	Breed†	Use	Reason for Referral
Sacroiliac arthrosis (n = 6)	1	6	♂	TB	Dressage	Hindlimb stiffness, lameness, and poor performance
	2	3	♂	SVB	Hack	Pelvic asymmetry and suspected sacroiliac condition
	3	10	♂	TB	Hack/ dressage	Mild hindlimb lameness and suspected sacroiliac condition
	4	12	♂	TB	Hack	Suspected sacroiliac condition
	5	4	♂	STB	Trotter	Poor performance and pelvic asymmetry
	6	9	♂	SVB	Hack	Chronic low back problem
Lumbosacral abnormality (n = 3)	7	5	♀	STB	Brood mare	Hindlimb lameness
	8	7	♀	SVB	Hack	Suspected sacroiliac condition
	9	9	♂	STB	Trotter	Poor performance, mild hindlimb lameness, and pelvic asymmetry
Lumbar, sacral, and pelvic fracture (n = 6)	10	6 wks.	♂	STB	—	Partial paraplegia
	11	6	♀	STB	Trotter	Loss of performance and lameness at fast paces
	12	2	♀	STB	Potential trotter	Suspected pelvic fracture
	13	11	♂	STB	Trotter	Hindlimb lameness and suspected pelvic fracture
	14	1½	♂	STB	Potential trotter	Suspected pelvic fracture
	15	1½	♀	STB	Potential trotter	Suspected pelvic fracture
No radiographic changes detected (n = 5)	16	7	♂	STB	Hack	Suspected low back problem
	17	4	♂	STB	Trotter	Poor performance due to suspected sacroiliac problem
	18	4	♀	SVB	Hack	Obscure hindlimb lameness
	19	10	♀	SVB	Hack	Obscure hindlimb lameness
	20	4	♀	STB	Trotter	Poor racing performance

\* ♂ = gelding.

† TB = Thoroughbred; STB = Standardbred; SVB = Swedish Warmblood.  
Hack = general riding horse.

performance associated with lack of impulsion from the quarters and intermittent or low-grade hindlimb lameness. The problem was primarily unilateral, but some contralateral involvement was often encountered. Another important clinical sign was noticeable asymmetry of the hindquarters, usually due to muscle atrophy of the gluteal mass with slight lowering of the tubera coxae and tubera sacrale on the affected side. Clinical examination of the back and hindlimbs proved inconclusive.

Survey radiography of the pelvic, sacral, and lumbar regions revealed no diagnostic findings. On linear tomograms some irregularity of the outline of the sacral wing, with apparent widening of the sacroiliac joint space, was seen. In five riding/dressage horses (Horses 1–4, 6) there was also evidence of spur formation at the caudal wing of the sacrum and arthrosis involving the auricular surface of the wing of the ilium (Fig. 1). These changes were usually bilateral but more pronounced on the clinically affected side. The remaining horse (Horse 5) was a Standardbred trotter in which the arthrosis was not confined to the caudal sacral wing but seemed rather to involve the entire lateral aspect of the sacroiliac articulation (Fig. 2). In

addition, the vertebral body of L<sub>6</sub> was slightly malaligned to the left, and the lumbosacral intervertebral space was less distinct than normal.

Only one of these horses became available for post-mortem examination (Horse 6). Considerable spur formation at the caudal wing of the sacrum was found (Fig. 3). A large notch of new bone had formed on the auricular surface of the ilium, but no demonstrable damage in the ventral sacroiliac ligaments was present. The spur on the caudal sacral wing was covered with articular cartilage.

#### *Lumbosacral Abnormalities*

Clinical signs in these horses were obscure hindlimb lameness, the cause of which was suspected to be a sacroiliac abnormality. Pelvic asymmetry was present in two of the three horses. Tomographic evaluation of two of the horses (Horses 7 and 8) demonstrated evidence of fusion of the last lumbar intervertebral disc spaces (L<sub>5</sub>–L<sub>6</sub>) (Fig. 4). The principal radiographic change was loss of the lumbosacral intervertebral space due to partial ankylosis, accompanied by a wider than normal L<sub>5</sub>–L<sub>6</sub> intervertebral space. The sa-



FIG. 1. (A) Linear tomogram and (B) line diagram of the lumbosacral region at a plane of cut of 165 mm in a 6-year-old Thoroughbred gelding with sacroiliac arthrosis (Horse 1).

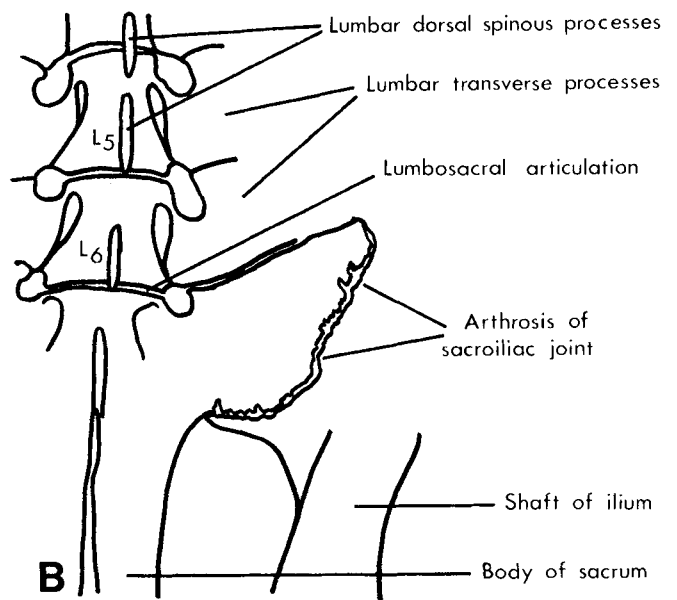
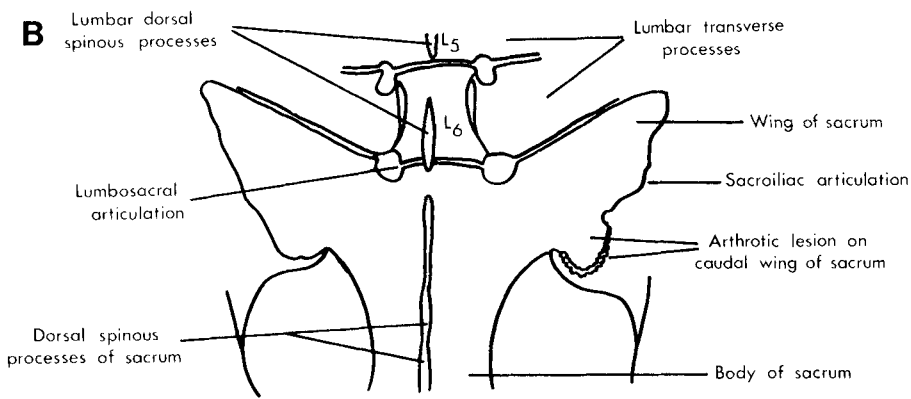


FIG. 2. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 150 mm in a 4-year-old Standardbred in which irregularity and arthrosis affecting the lateral aspect of the right sacroiliac joint can be seen (Horse 5).

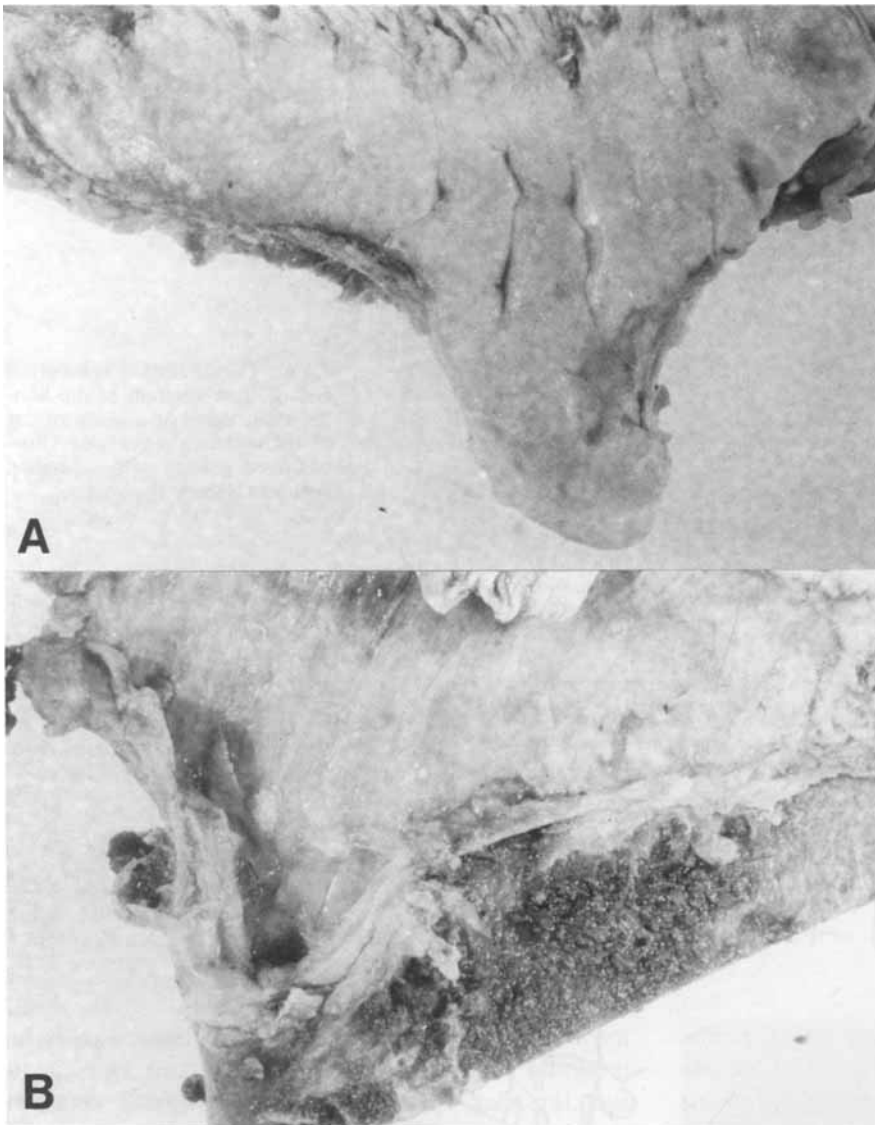


FIG. 3. Postmortem appearance of the (A) sacral and (B) auricular surfaces of the left sacroiliac joint of a 9-year-old Swedish Warmblood (Horse 6). There is marked spur formation on the caudal aspect of the sacral wing, which is covered by articular cartilage. The spur articulates with a large notch in the opposing auricular surface of the ilium.

cral wings were unusually narrow, and on one side partial or complete fusion with the transverse process of L<sub>6</sub> had occurred. In Horse 8 the sacroiliac articulation (on the side not fused to the L<sub>6</sub> transverse process) was indistinct and apparently undergoing ankylosis (Fig. 5).

Horse 9 exhibited consistent loss of performance as a trotter, with low-grade left hindlimb lameness, but showed radiographic changes very different from those of the two previously discussed horses. The lumbosacral intervertebral space and the articulations between the wings of the sacrum and the L<sub>6</sub> transverse processes appeared much wider than normal (Fig. 6); this condition was accompanied by evidence of low-grade sacroiliac arthrosis. At postmortem examination no detectable abnormalities were noted in the lumbosacral intervertebral space or the articulation between the sacral wings and transverse processes of L<sub>6</sub>. However, signs of bilateral low-grade sacroiliac arthrosis

with spur formation at the caudal aspect of the joints were present.

#### *Fractures of Lumbosacral and Pelvic Regions*

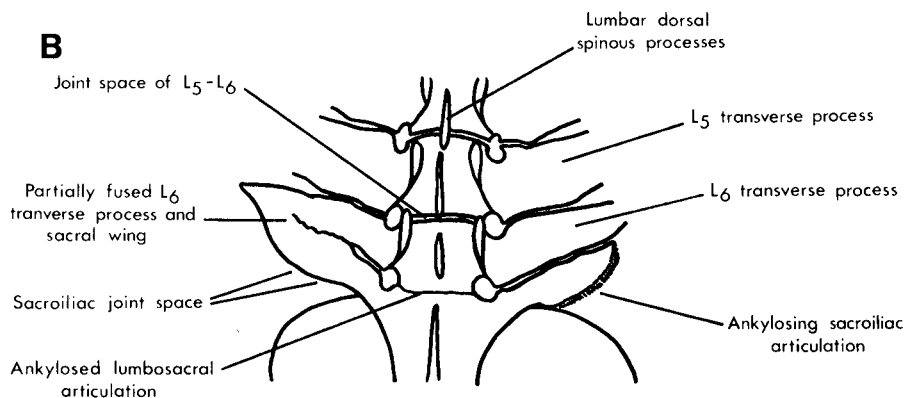
Linear tomography proved beneficial in confirming the site and providing a more accurate prognosis in six horses with a lumbosacral or pelvic fracture (Table 2). Lesions were confirmed at postmortem examination in four of the six cases.

In Horse 10, a foal presented with a sudden onset of partial paraplegia, a crushed first lumbar vertebra was detected by lateral survey radiography. The extent of the fracture site and crushing of the vertebral body of L<sub>1</sub> could be clearly seen on the ventrodorsal tomogram taken at a plane of cut of 80 mm above the surface of the table (Fig. 7). Upon myelography, made by injection of 20 ml of metrizamide† into the atlanto-

† Amipaque, Nyegard, AB, Norway.



FIG. 4. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 150 mm in a 5-year-old Standardbred mare with obscure hindlimb lameness (Horse 7). There is sacralization of L<sub>5</sub>-L<sub>6</sub> with fusion of the left sacral wing and transverse process of L<sub>6</sub>.



occipital space, stenosis of the vertebral canal just proximal to L<sub>1</sub> was identified.

Horse 11 had a long history of poor racing performance. Trotting at speeds of greater than 7 m/second evoked a hiking-type lameness in the left hindlimb. Clinical examination, including selective nerve blocks up to and including the hip joint, did not reveal the site of lameness. Survey radiographs of the thoracolumbar spine (T<sub>2</sub>-L<sub>6</sub>) and pelvic region were normal. In a tomogram at a plane of cut of 155 mm, a suspected partial nonunion in a fracture of the sacral wing was seen (Fig. 8). In Horse 12 a comminuted fracture of the shaft of the ilium was complicated by a complete longitudinal fracture line through the left sacral wing. This second fracture site was not visible on survey ventrodorsal radiographs (Fig. 9) but was clearly seen at postmortem examination (Fig. 10).

Horse 13 became acutely lame in the hindlegs with marked asymmetry of the hindquarters after an accident. An overriding fracture of the body of the ischium was seen on survey radiographs, but in a tomogram at

a height of 150 mm a much more distinct and wider sacroiliac joint space was seen on the affected side (Fig. 11). This change was suggestive of sacroiliac strain or subluxation which could have accounted for the pronounced asymmetry of the quarters seen clinically. Horse 14 had a previous history of ischial fracture and possible acetabular involvement. Tomography confirmed the presence of a low-grade, chronic osteoarthritis at the caudal aspect of the hip joint (Fig. 12), which was confirmed at necropsy.

In survey radiographs of Horse 15 a chronic overriding fracture of the ilial shaft with possible extension into the acetabulum was seen. In linear tomograms, it could be seen that a narrow fragment of ilial shaft had passed behind the acetabulum but did not involve the hip joint itself (Fig. 13).

#### *No Radiographic Findings*

In five of the horses examined (Table 1) no significant radiologic abnormalities were detected on survey

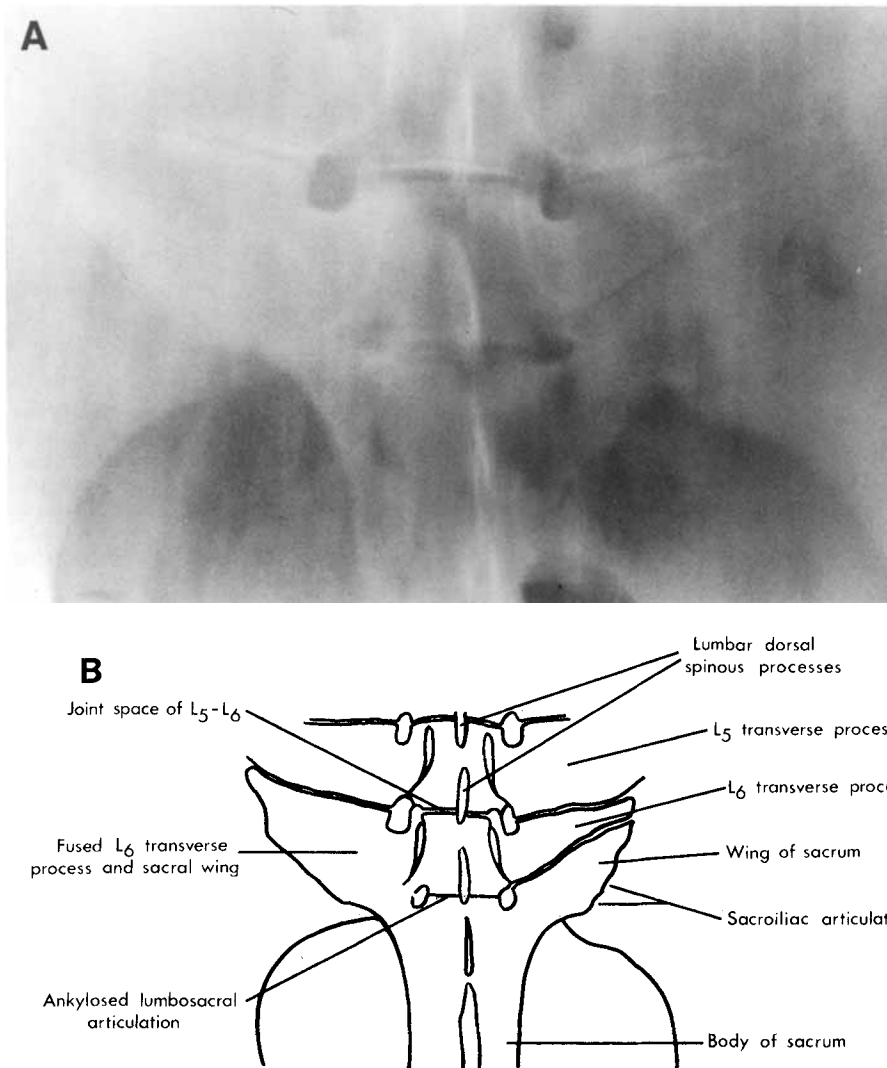


FIG. 5. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 150 mm in a 7-year-old Swedish Warmblood mare with poor hindlimb performance (Horse 8). There is sacralization at L<sub>5</sub>-L<sub>6</sub> and partial fusion of the left transverse process of L<sub>6</sub> and the sacral wing, with an apparently ankylosing right sacroiliac articulation.

radiographs or tomograms of the lumbosacral and pelvic regions. Although the clinical histories in these horses suggested a possible sacroiliac or lumbosacral abnormality, the clinical history was not typical, and tomography was performed as an eliminative procedure. None of these horses was available for follow-up or postmortem examination.

### Discussion

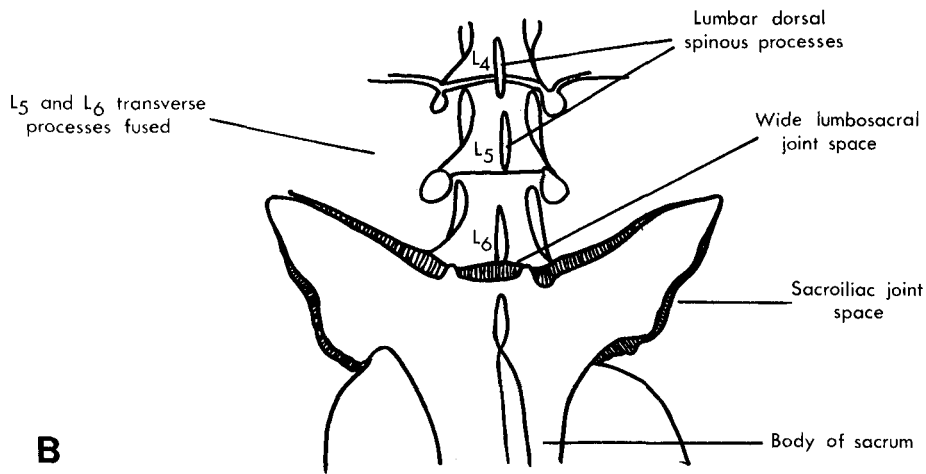
Previous accounts of radiography of the equine pelvis have concentrated mainly on sites of fracture.<sup>2,3</sup> This is the first report of an attempt to use linear tomography of the equine pelvic region as an aid to diagnosis of obscure hindlimb lameness. Tomography has been helpful in permitting visualization of the lumbosacral spine, pelvis, sacroiliac joints, and associated structures.<sup>8</sup> However, interpretation is hampered due to lack of knowledge of normal morphology and func-

tional anatomy of the lumbosacral and sacroiliac articulations. In humans some elegant radiographic and morphologic studies, including an assessment of the normal range of movement,<sup>9,10,11</sup> have greatly assisted in the clinical evaluation of back pain. Pathologic analysis of traumatic sacroiliac strain or subluxation has received some attention<sup>4,12</sup> in horses with gross ligamentous damage. However, a more prevalent clinical entity may be that due to long-standing sacroiliac instability, which results in low-grade arthrosis.<sup>5</sup>

The prevalence of chronic sacroiliac damage in Standardbreds as compared with Thoroughbreds has been noted, but a detailed description of the changes involved has not been provided. The radiologic findings of arthrosis in six horses in the present series seem to confirm the possibility that this is an important clinical entity. The biomechanical theory behind the production of these lesions was described recently<sup>13</sup> with some suggestions for their prevention.



A



B

FIG. 6. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 150 mm in a 9-year-old Standardbred gelding (Horse 9). There is apparent widening of the lumbosacral, sacroiliac, and joint space between the transverse process of L<sub>6</sub> and the sacral wing.

TABLE 2. Radiographic Findings in 6 Horses with Lumbar, Sacral, or Pelvic Fracture Examined by Linear Tomography

Horse No.	Radiographic Diagnosis
10	Crush fracture of L <sub>1</sub> and L <sub>2</sub> with vertebral stenosis
11	Partial nonunion fracture of sacral wing
12	Complete fracture of sacral wing and comminuted fracture of shaft of ilium
13	Overriding fracture of ischium and possible sacroiliac subluxation
14	Fracture of body of ischium with secondary osteoarthritis of hip
15	Overriding fracture of shaft of ilium without acetabular involvement

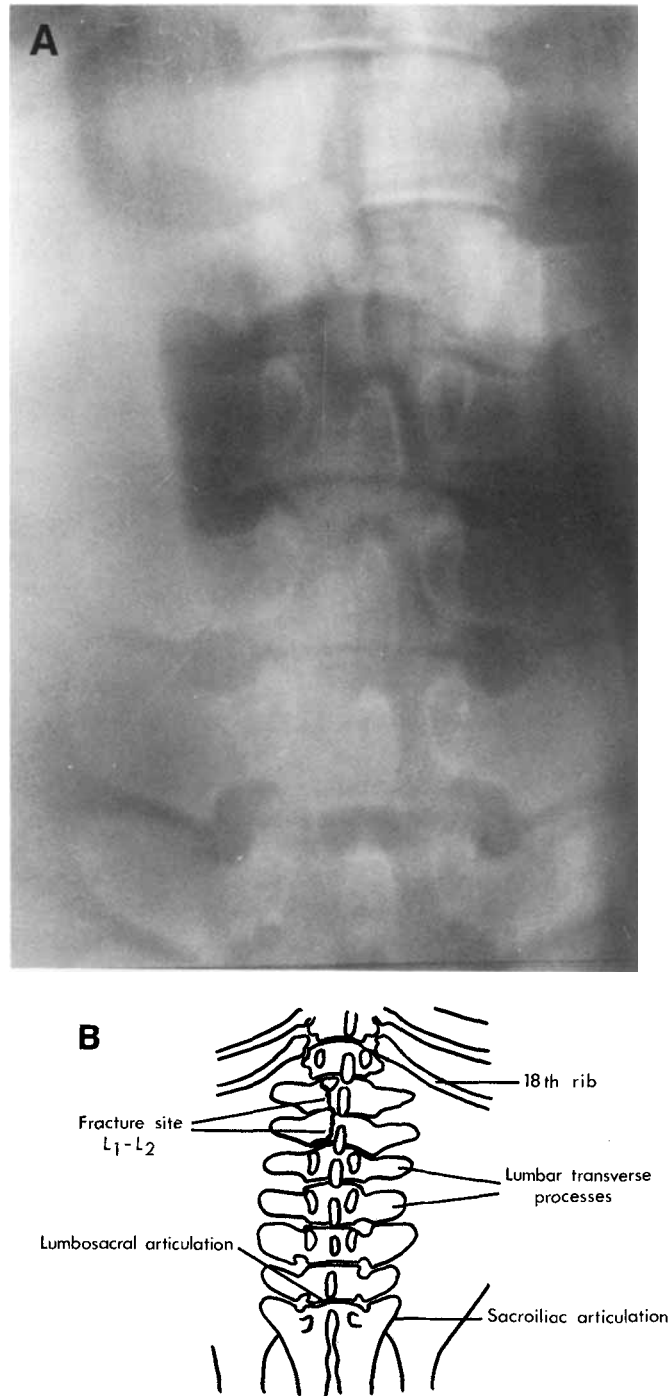


FIG. 7. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 80 mm in a 6-week-old Standardbred colt (Horse 10). There is a fracture through the vertebral body of L<sub>1</sub> and L<sub>2</sub>.



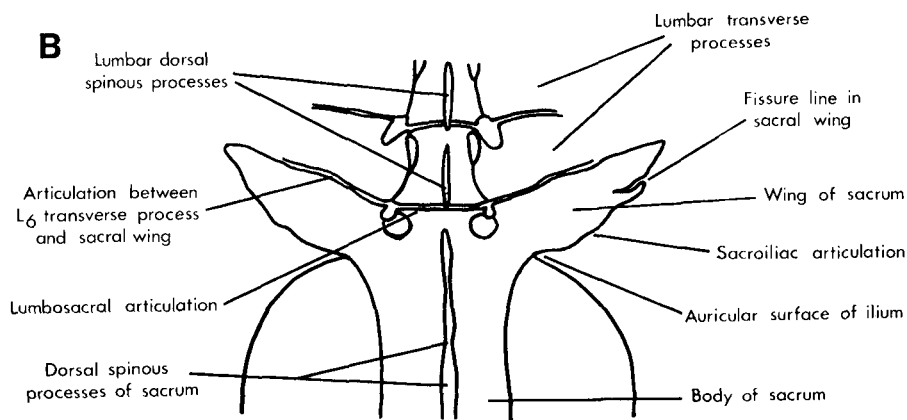
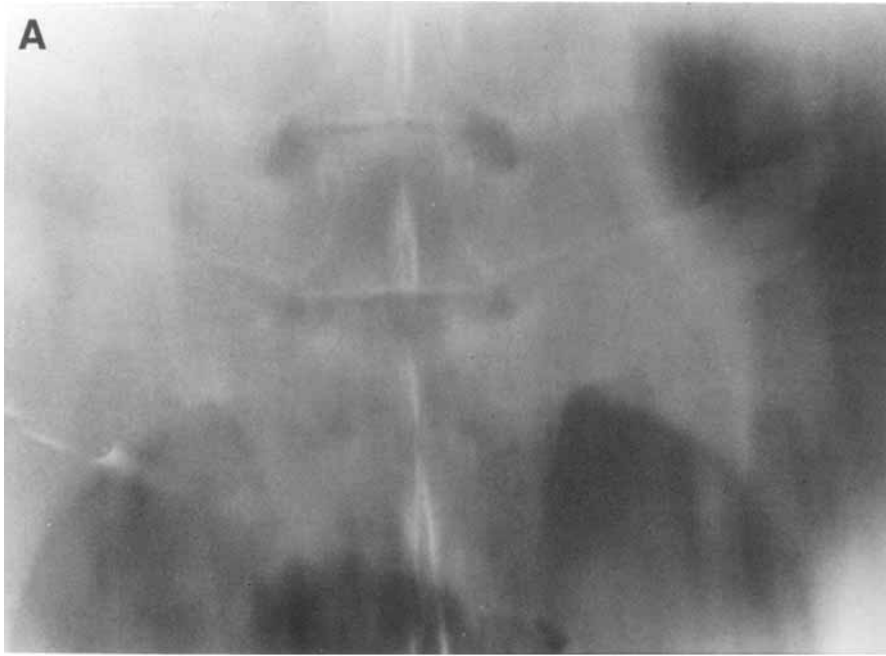
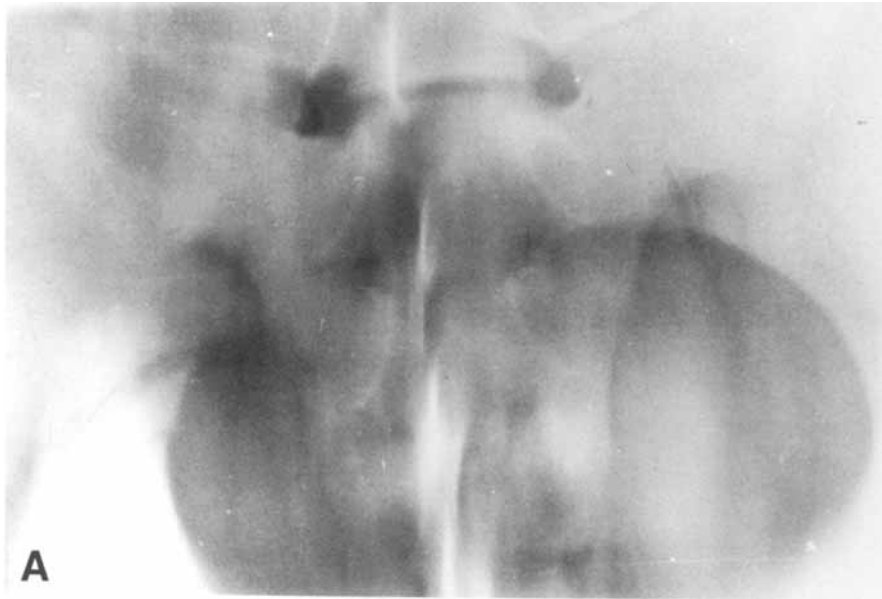
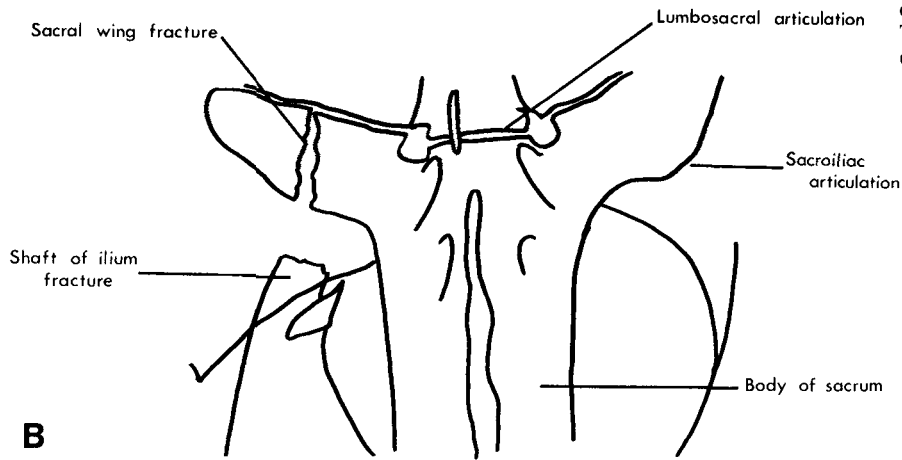


FIG. 8. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 155 mm in a 6-year-old Standardbred mare exhibiting obscure right hindlimb lameness (Horse 11). A fissure line in the right sacral wing was detected.



**A**

FIG. 9. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 120 mm in a 2-year-old Standardbred (Horse 12). There is a fracture of the left sacral wing.



**B**

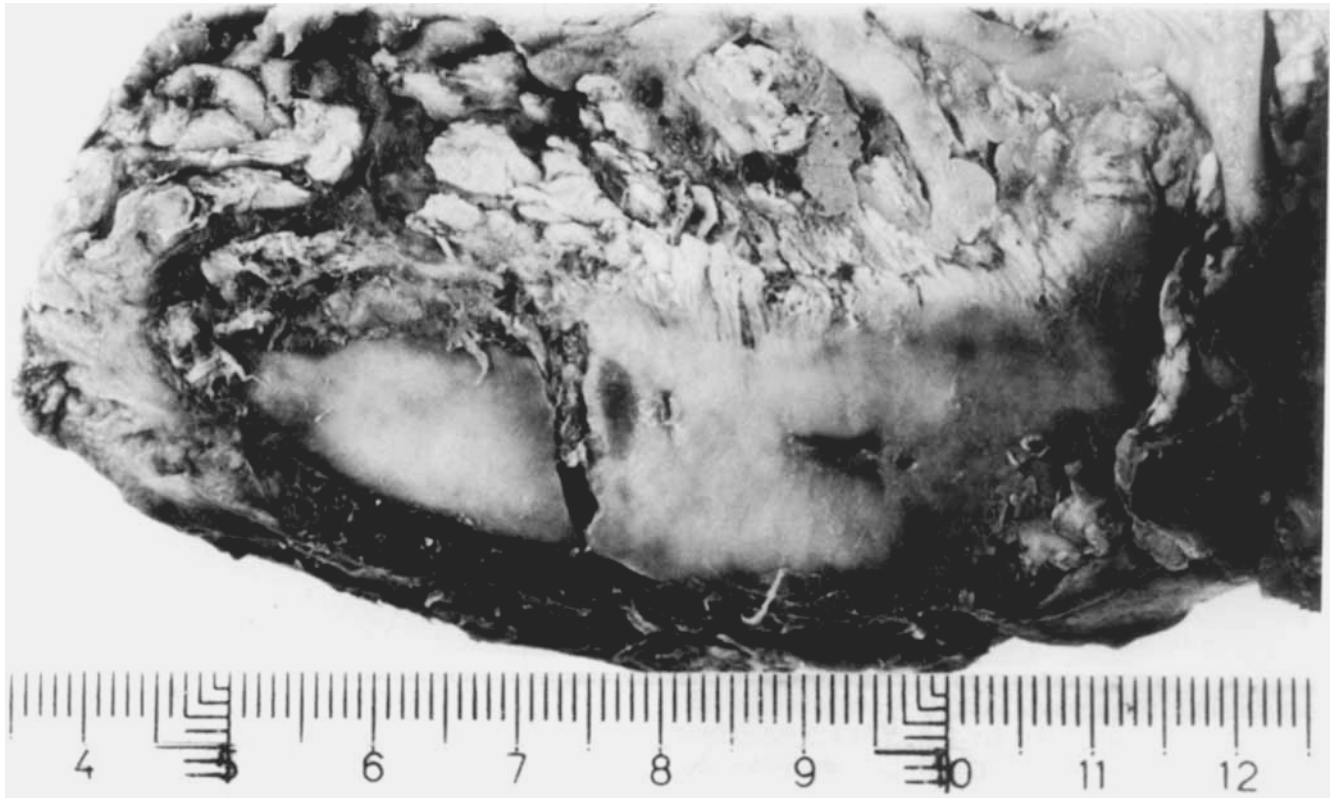


FIG. 10. Postmortem appearance of fracture in the left sacral wing of a 2-year-old Standardbred (Horse 12).

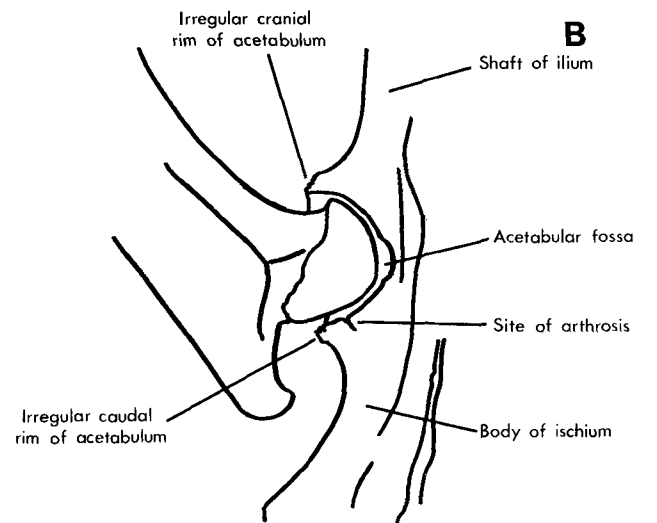
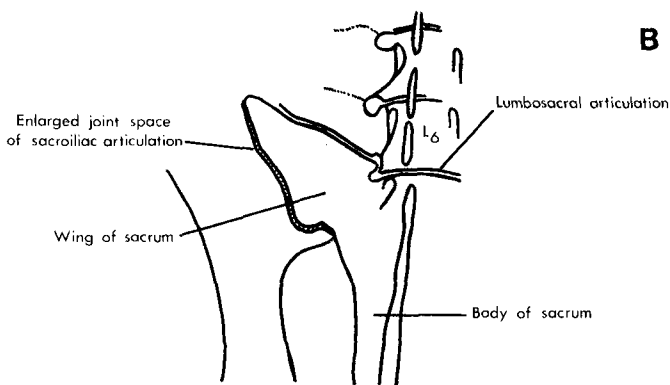


FIG. 11. (A) Linear tomogram and (B) line drawing taken at a plane of cut of 150 mm in an 11-year-old Standardbred (Horse 13) with a pelvic fracture. Considerable widening of the left sacroiliac articulation is present.

FIG. 12. (A) Linear tomogram and (B) line drawing of the hip of a 2-year-old Standardbred taken at a height of 220 mm (Horse 14). A previous fracture of the ischium has healed, but secondary arthrosis of the acetabulum is detectable.

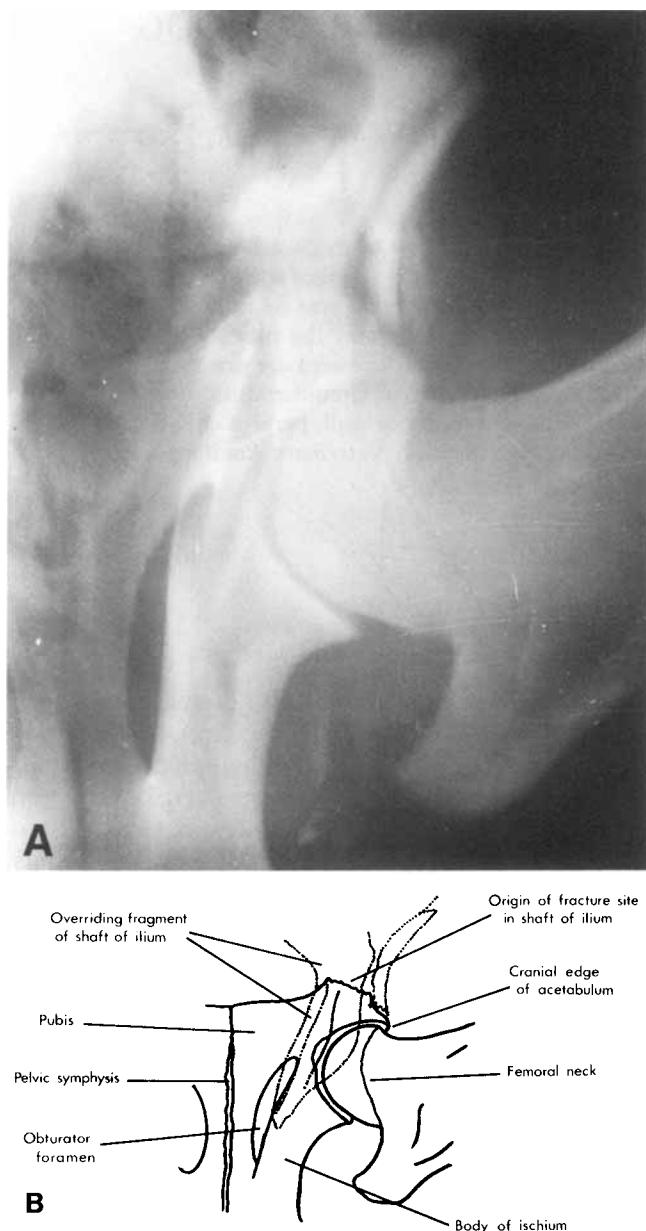


FIG. 13. (A) Linear tomogram and (B) line drawing of the hip region of a yearling Standardbred (Horse 15) in which a comminuted, overriding fracture of the shaft of the ilium can be seen.

In anatomic accounts of the lumbosacral region of the horse<sup>14,15,16</sup> there is no mention of sacralization or the presence of transitional vertebrae as a common finding. In humans sacralization of the fifth lumbar vertebra has been incriminated as a cause of severe low back pain.<sup>17</sup> This type of abnormality is noted in approximately 2% of dogs as an apparently incidental radiologic finding.<sup>18</sup> The clinical significance of the fusion of the lumbosacral space with apparent sacralization of L<sub>6</sub> and associated changes observed in two horses in the present series is uncertain, but it may well have predisposed these horses to the low-grade hindlimb lameness and loss of performance encountered. A similar clinical history was reported in a single case of so-called subluxation of L<sub>5</sub> in a series of 443 horses referred for back problems.<sup>5</sup> If tomography had been available in this case, a more accurate description of the abnormality might have been possible. In retrospect, it seems likely that a partial fusion at the L<sub>5</sub>-L<sub>6</sub> articulation, associated with a mild compensatory spinal curvature, was present. In another horse in the same series<sup>5</sup> congenital vertebral fusion at L<sub>1</sub>-L<sub>2</sub> (synostosis) was accompanied by local scoliosis and kyphosis of the vertebral column. Tomography could also be utilized for better visualization of lumbar and pelvic fractures, particularly those in which overriding of bone fragments is present. Use of tomography gives valuable prognostic information and improves radiologic diagnosis as well. Lesions within the hip joint are less common, but the changes of osteoarthritis, osteochondrosis, and hip dysplasia would be more accurately defined by tomography than by survey radiography.

It is concluded that linear tomography of the equine lumbosacral and pelvic regions can be beneficial in selected horses with hindlimb or back problems. At this stage it does not always provide a definitive diagnosis but can materially assist the radiologist in defining structural changes in this area and in eliminating certain important conditions (*e.g.*, sacroiliac arthrosis).

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