Resolution of Low Back Pain in a 9 Year Old Male with Low Back Pain, Tethered Cord Syndrome, Spina Bifida Occulta and Lumbarization of the S1 Vertebra Following Chiropractic Care: A Case Study & Selective Review of the Literature

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Abstract

Objective: To describe the chiropractic care of a pediatric patient with low back pain and complicating conditions.

Clinical Features: A 9-year-old male presented with dull, achy low back pain that occurred during practice and playing football. Examination revealed decreased range of motion and vertebral subluxations. Lumbar spine radiographic examination revealed 6 non-rib bearing segments due to absence of T12 ribs. MRI examinations noted tethering of the spinal cord with an ill-defined conus medullaris that extended to the L1 vertebral level, a small syrinx cavity within the attenuated conus of the cord limited to the L2-3 and dysraphism of the dorsal arches of the L5 and S1 vertebra without evidence of lipomyelomeningocele.

Intervention and Outcome: The patient was cared for with Diversified spinal adjustments and adjunctive therapies over the course of twice per week for 3 weeks and then one visit per week for 6 weeks with recommended physical stretching and exercises to be continued daily at home. At one-year follow-up, the patient was able to play several high school sports without any complications.

Conclusion: This case report provides supporting evidence on the effectiveness of chiropractic care in children suffering from low back pain concomitant with spinal congenital anomalies.

Keywords: Vertebral subluxation, tethered cord syndrome, spina bifida, pediatric, low back pain, adjustment, spinal manipulation

Introduction

Low back pain in the pediatric population is a common occurrence. Prevalence of low back pain (LBP) in children ranges from 9% to 66%, depending on the source, population and pain definition.1,2 Other studies report a lifetime prevalence ranging from 4.7% to 74.4%.3 In terms of incidence, a prospective population-based cohort study involving 1046 schoolchildren, aged 11 to 14 years, identified as being free of LBP at baseline, had 19% reporting LBP 12 months later. In 1,245 schoolchildren aged 8, 11, and 13 years of age, 16%, 22%, and 22% reported LBP 12 months later.4 To assess the impact of the disorder and the role of both mechanical and psychosocial factors in pediatric low back pain, Watson et al.5 found a strong association between LBP...
and emotional problems, conduct problems, troublesome headaches, abdominal pain, sore throats, and daytime tiredness.

Given this LBP-related disability in childhood, parents naturally seek care for their children suffering from LBP. Chiropractic is popular and highly utilized by adults with spinal pain and given that parent-users of alternative therapies are more likely to use these therapies for their children. Chiropractic is also popular for children presenting with spinal pain complaints such as LBP. Indeed, among Danish chiropractic patients younger than 18 years, Hestbaek et al. found that musculoskeletal problems were the most dominant complaint, ranging from 33% among the preschool children to 75% among the teenagers. Similar findings have been observed by Alcantara et al. within a pediatric practice-based research network and in teaching clinics. Despite the popularity of the chiropractic care of children with LBP, this morbidity has not been well studied or documented in the scientific literature. In the interest of evidence-informed practice and research, we describe the chiropractic care of a child with a presenting complaint of LBP.

Case Report

History

A 9-year-old male presented for chiropractic consultation at a chiropractic clinical training center with a chief complaint of LBP. According to the patient’s parents, their child’s symptoms became noticeable one month prior when he began to participate in a local organized football practice.

The patient’s parents deny any previous treatment by a healthcare provider or alternative practitioner for the patient’s chief complaint. However, the child was given liquid Children’s Tylenol and bed rest as a form of self-care. This approach provided only temporary relief of the patient’s symptoms.

The pain complaint was characterized by the child as a dull ache in his low back that occurred during practice and playing football. He stated that this has also occurred when carrying his backpack at school. At times, the pain was of such intensity that it caused him to want to sit down. Sitting and resting seemed to placate the symptoms. The patient rated his pain complaint at 6/10 on the visual analogue scale (0=no pain; 10=most severe pain). He denied the presence of radiating pain to either lower extremity. The site of pain was indicated as located posterior to the midline of his waistline. The patient indicated his pain complaint presented and worsened with increased physical activity and in the evenings.

Past history and examination were notable for a fracture of the right distal humerus that occurred four years prior due to a fall from an upper bunk bed. His parents also reported a history of asthma since birth that required a series of nebulizer treatments on an as needed basis.

Examination

On physical examination, postural inspection demonstrated a slightly elevated right shoulder. A significant hairy patch or “fawn’s beard” was apparent and centrally located at the L₄-L₅ vertebral region of the spine. The patient was noted as standing with a toe-in, bilaterally. The observed toe-in was also noticeable along with toe-tip walking on gait analysis.

Static and motion palpation examination revealed subluxations. Tenderness was elicited from the L₃-L₅ spinal levels with a spongy end-feel. Left rotation of the L₅ vertebra was decreased on range of motion assessment. The patient had decreased lumbar flexion, extension and bilaterally on lateral flexion by approximately 10° in all planes of motion. Orthopedic and neurological tests of the lumbar spine and lower extremity were negative.

Based on the history and examination findings, anteroposterior and lateral view radiographs (Figure 1A and 1B) of the lumbar spine were performed and revealed 6 non-rib bearing segments consistent with absent T12 ribs, as well as a non-union of the posterior arch elements of L5 and S1 (i.e., spina bifida occulta). Lumbar magnetic resonance imaging (MRI) was subsequently ordered to determine if spinal cord tethering was present (Figure 2 and Figures 3A-3D). MRI demonstrated tethering of the spinal cord with an ill-defined conus medullaris. The conus medullaris may have extended as low as the L₄ vertebral level. There was a small incidental syrinx cavity within the spinal cord limited predominantly to the L2 and L3 vertebral levels. Dysraphism of the dorsal arch of the L₅-S₁ and S₁₂ vertebral levels was noted without evidence of lipomyelomeningocele.

Intervention & Outcomes

A pediatric neuro-surgical referral and consult was recommended to the child’s parents. Based on the history and physical examination findings, the patient was provided a working diagnosis of spina bifida occulta with posterior subluxations at the lumbosacral spine with spinal cord tethering. The child’s parents consented to a trial of chiropractic care. On the first visit post-consult with a pediatric neurosurgeon, chiropractic adjustment characterized as high velocity, low amplitude (HVLA) thrusts known as Diversified Technique was initiated to the subluxated regions twice per week for 3 weeks along with low back stretching and core strengthening exercises to be performed daily.

An anti-inflammatory diet was recommended to include avoidance of all processed food products. The patient responded well to care and had an immediate improvement in his low back pain complaint post initial spinal adjustments. The patient continued care as recommended with a reduction to one visit per week for 6 weeks with recommended physical stretching and exercises to be continued daily at home. The patient was able to continue football under described care protocol and did not require surgery to release the spinal cord tethering. A one-year co-management follow up to include re-examination with MRI demonstrated that the tethering was no longer a concern to warrant annual follow-up with the pediatric neurosurgeon. The patient has been able to play several years of high school sports (football, field hockey, wrestling) without any complications and has performed so with chiropractic care as needed and without pain.
Discussion

This case report presents a number of salient topics for discussion. We presented the care of a pediatric patient presenting with a chief complaint of LBP. From both radiological and MRI studies, the patient was found to have congenital anomalies (multi-level spinal bifida occulta) and tethered cord syndrome.

There is no denying that congenital anomalies that alter structure and function of the spine are an important clinical consideration in spinal care – allopathically or otherwise. Harreby et al.12 found that 13% of 14-year-old schoolchildren had radiological abnormalities of the spine—the majority being Schuermann’s changes. Iwamoto et al.13 examined the relationship between prevalent radiographic abnormalities of the lumbar spine and the incidence of LBP among high school rugby players and found a number of abnormalities with their prevalence on radiographs that included spondyloysis (15.6%), disc space narrowing (13.1%), spinal instability (32.7%), Schmorl’s node (14.1%), balloon disc (11.6%), and spina bifida occulta (30.6%). Milicic et al.14 found a causal connection of non-specific low back pain and disc degeneration in children with transitional vertebra and/or spina bifida occulta.

Spina bifida is a developmental anomaly resulting in a failure of the laminae of one or more vertebral arches to fuse in the midline. The most innocuous form is spina bifida occulta, where no herniation of spinal cord or meninges occurs. Spina bifida occulta most commonly occurs in the fifth lumbar and/or upper first or upper two sacral vertebrae and occasionally affects the upper components of the dorsal sacral arch. According to some, spina bifida occulta of the sacrum is the most common type of spinal deformity. Many authors have published data on the frequency of spina bifida occulta, with varying results. Some possible reasons for this variability could include the differing methods used to gather data and differing ways of classifying the condition.15 Saluja16 noted that there is a paucity of data concerning the frequency of spina bifida occulta for two reasons. One, the condition is usually asymptomatic and often is undetected. Two, some radiologists regard spina bifida occulta as a normal anatomical variation and do not record it in their reports. Saluja16 found the prevalence of a historic and modern population of Londeners at 15.2% and 15.7%, respectively.

Tethered spinal cord syndrome (TSCS) is a neurological disorder caused by spinal tissue attachments resulting in limited movement of the spinal cord within the spinal column. Garceau first described the disorder as “filum terminale syndrome” in 1953.17 Twenty years later, Hoffman et al.18 coined the term “tethered spinal cord” to describe the symptoms of patients with an elongated spinal cord and a thick filum terminale. In 1981, Yamada et al.19 broadened this stretch-induced functional disorder to patients with other anomalies. In children with TSCS, symptoms may include lesions, hairy patches, dimples, or fatty tumors on the lower back; foot and spinal deformities; weakness in the legs; low back pain; scoliosis; and incontinence.

This type of TSCS appears to be the result neural tube defects during fetal development, and is closely linked to spina bifida.

CSTS is a progressive disorder and may go undiagnosed until adulthood, when pain, sensory and motor problems, and loss of bowel and bladder control emerge. This progression of symptoms is related to the degree of strain placed on the spinal cord over time and may be exacerbated during sports or pregnancy, or may be due to narrowing of the spinal column (stenosis) with age. In the child reported in this case report, the child suffered from low back pain one month following participation in local organized football. Tethering may also develop following spinal cord injury with scar tissue formations blocking the flow of cerebrospinal fluid (CSF). The CSF pressure may cause cysts to form in the spinal cord resulting in a condition called syringomyelia. This can lead to additional motor and sensory loss or the onset of pain or autonomic symptoms such as urinary urgency, or incomplete voiding.20

Of all the physical therapy treatments for low back pain in children and adolescents, the combination of therapeutic physical conditioning and manual therapy is the most effective.2

As alluded to earlier, children present commonly for chiropractic care. Most notably for musculoskeletal-related complaints such as neck pain.21 Searching databases including Pubmed (1966-2015), MANTIS (1964-2015) and Index to Chiropractic Literature (1980-2015), we examined the literature on the chiropractic care of children with low back pain. Our search terms was “low back pain” and inclusion criteria for examination were those articles published in English, peer-reviewed journals. We found only a handful of studies. In a secondary data analysis of the National Health Interview Survey 2007, Child Alternative Medicine file as well as the Child Core Sample, Ndetan et al.22 found that children aged 12-18 years were more likely to have seen an osteopathic or chiropractic provider than younger age groups with the most common complaints being back and neck pain.

To examine the use of complementary and alternative medicine (CAM) in an insured pediatric population, Bellas et al.22 found that of 187,323 children covered by 2 large insurance companies, 156,689 (83.6%) had any claims during the year. For those with claims, 6.2% of children used an alternative professional during the year, accounting for 1.3% of total expenditures and 3.6% of expenditures for all outpatient professionals. CAM use was significantly less likely for males and more likely for children with cancer, children with low back pain, and children with adult family members who use CAM. In terms of clinical care, Mierau et al.23 found a high percentage of school aged children had sacroiliac dysfunction and low-back pain. King et al.24 discussed through a case report vehicle the difficulty in making the diagnosis and conservatively managing lumbar disc herniations in children.

Maroom et al.25 reported the successful care of an infant with Dandy Walker Syndrome suffering from unspecified unilateral right-sided headaches, neck pain, and low back discomfort. The patient was cared for with a combination of Diversified and Thompson Technique chiropractic adjustments with adjunctive therapies with improvement in symptoms. To date and to the best of our knowledge, the publication by Hayden et al.26 is the only study examining specifically the chief
complaint of low back pain in the pediatric population under chiropractic care. In a practice-based study of Canadian chiropractors with pediatric patients (i.e., 4-18 years of age) presenting for low back pain, the investigators found that of 54 children (average age = 13.1 years; 57% were male, 61% were acute), with 47% attributed onset to a traumatic event (most commonly sports-related); 24% reported an episode duration of greater than 3 months and almost 90% of cases presented with uncomplicated mechanical LBP, most frequently diagnosed as lumbar facet dysfunction or subluxation. Patients were managed with spinal manipulation, with a minority (7.7%) receiving some form of active management. "Important" improvement was seen in 62% and 87% on the visual analogue and subjective scales, respectively, within a 6-week course of management.

To provide context to our discussion on the chiropractic care of a pediatric patient with low back pain with spinal bifida occulta, lumbarization of the S1 vertebra and tethered cord syndrome, we performed a systematic review of the literature. We utilized the same databases as above using the search words congenital anomalies, spina bifida occulta, tethered cord syndrome, spine and low back pain in various Boolean combinations. Given the limitations of reports involving children, we decided to include both adult and pediatric subjects reported in English. The summary of our findings are provided in Table 1.

Upon examination of the literature, the controversy on the necessity of radiographs in patients presenting to chiropractic practices and the possibility of a congenital anomaly presents itself. For example, Gregerson38 found the reported frequency of occurrence of SBO at 17% of examined spines. Conversely, Hsieh et al.39 estimated the rate of occurrence of lumbosacral transitional segments chiropractic practice to be low. We concur with Jenkins et al.40 that clinically significant congenital and developmental anomalies in the cervical and lumbar spine exist somewhat commonly, warranting closer inspection of the current x-ray guidelines.

Of the clinical case reports published, patients with congenital anomalies such as transitional vertebra or SBO were not contraindicated to receive chiropractic care such as high-velocity low-amplitude type spinal adjustments along with soft tissue therapy and exercise. Continued efforts on the documentation of patients with similar clinical presentation as in the case reported will shed light on the most efficacious approach to the care of such patients.

Despite the accepted limitation of case reports as lacking generalizability to confounders (i.e., lacking a control group, spontaneous remission, self-limiting course and natural history of the disorder, subjective validation, and expectations for clinical resolution), this case report is epistemologically in harmony with the clinical experiences of chiropractors in the care of similar patients and thus form the basis for generalization. Case reports provides clinicians (and patients) an understanding and affirmation of their clinical experiences that may lead to increase in their conviction that chiropractic can “help” with similar patients.

Conclusion

This case report described the successful chiropractic care of a child presenting with a chief complaint of low back pain associated with spina bifida occulta and tethered cord syndrome. We encourage further research to examine the safety and effectiveness of chiropractic in such patients.

References


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<th>Reference</th>
<th>Age Gender</th>
<th>Clinical Commentary</th>
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<tr>
<td>Cofano et al.</td>
<td>10-year-old male</td>
<td>The patient was referred for chiropractic care by his pediatrician for low back pain following a fall 3 days prior. Examination and medical records revealed the patient had spina bifida occulta at the level of L₅. The patient was cared for with high-velocity low-amplitude type spinal adjustments with resolution of the child’s complaint after 6 visits. No adverse effects were reported.</td>
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<td>Glover et al.</td>
<td>Not Applicable</td>
<td>The authors examined 32 patients with spina bifida occulta of C₁ with a similarly numbered control group and found that the frequency of headaches and neck pain was not associated with spina bifida occulta of C₁.</td>
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<td>Muir</td>
<td>29-year-old male</td>
<td>This is the care of a patient presenting with a chief complaint of low back pain and. Care was described as manual therapy, soft tissue therapy, and exercise/stretching with the presenting symptoms resolving following a short course of care. However, the patient returned after 3 symptom-free months. At that time, radiographs were ordered and the LSTV (i.e., Castellvi type II LSTV) was identified. Following another course of chiropractic care, the patient's symptoms resolved.</td>
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<td>Muir</td>
<td>51-year-old female</td>
<td>Two patients with LSTV involving unilateral sacralization of L₅, a Castellvi type IIIa variant presenting with back pain. Each case presented with symptomatology similar to piriformis syndrome. The patients were cared for with spinal manipulation, soft tissue therapies and exercise/stretching. Approximately 2 weeks after initiation of care, the first patient subjectively reported a 70% improvement in symptoms, with lumbar extension increasing to full ROM at the lumbar spine but with continued tenderness and hypertonicity at the left piriformis and gluteus medius. After 4 weeks of treatment, the second patient reported improvement in pain and perceived mobility, although prolonged standing remained an aggravating factor. Although both showed improvement, neither patient resulted in complete resolution of symptoms.</td>
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<td>Keene</td>
<td>16-year-old male</td>
<td>An adolescent football player with a history of chronic LBP and multiple traumas presented for care. Radiographic examination showed a non-union at S₁ while MRI examination showed a disc herniation at L₅-S₁ VB. The patient was cared for over a period of 24 weeks. Flexion-distraction manipulation was utilized, along with physical therapy modalities and core-strengthening exercises. On re-evaluation, his condition was significantly improved.</td>
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<td>Jenkins et al.</td>
<td>Not Applicable</td>
<td>A retrospective study on 3519 spinal plain-film x-ray reports taken at a chiropractic teaching clinic within a 5 year period. Of the 3519 spinal x-ray reports, congenital anomalies were examined in 2814 cervical regions, 695 thoracic regions and 1052 lumbar regions. The total percentage of congenital or developmental anomalies found in 28.5% of the cervical spine, 0.7% in the thoracic spine and 18.3% in the lumbar spine. The most common anomalies found were posterior ponticles (21.3%), transitional lumbosacral vertebrae (16.64%) and cervical ribs (5.1%). The authors noted the presence of clinically significant congenital and developmental anomalies in the cervical and lumbar spine to warrant closer inspection of the current x-ray guidelines.</td>
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<td>Treble et al.</td>
<td>2.2:1</td>
<td>An examination of the relationship between an isthmic spondylolisthesis and a number of radiographic and clinical findings of patients presenting for care at a chiropractic teaching clinic. A total of 1,978 radiographic reports were reviewed from 3 student outpatient clinics, and only those with an isthmic spondylolisthesis were selected for further analysis. Of the 1,978 radiographic reports, 109 contained an isthmic spondylolisthesis. Of the 109 reports, there was a gender ratio of 2.2 males to every female; 34 had spina bifida occulta; and 10 had a transitional segment. Ninety-four corresponding patient records were found, and 67.02% of patients presented with a history of low back pain. The authors found that the prevalence of spondylolisthesis, gender relationship, lifetime prevalence of low back pain, and prevalence of spina bifida occulta were consistent with current literature. The authors noted that 79.37% of patients who have experienced low back pain and have an isthmic spondylolisthesis indicated on a pain diagram that they felt their low back pain in the low lumbar spine, sacroiliac joints and buttocks area, with pain referral into one or both legs as uncommon.</td>
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<td>Peterson et al.</td>
<td>Not Applicable</td>
<td>Radiographic data and a questionnaire from 353 patients with low back pain was collected. Patients were divided into 2 groups: those with and those without a transitional lumbosacral vertebra. Of the 353 patients, 43 (12.2%) had a transitional lumbosacral vertebra. The investigators found no differences in pain or disability levels between the 2 groups.</td>
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<td>Beck et al.</td>
<td>Not Applicable</td>
<td>An examination of 1004 random patient files between 1997 and 2001 at an outpatient teaching clinic was performed. In cases where radiographs were taken, the radiographic reports were analyzed for anomalies. Eight hundred forty-seven full-spine radiographs were included in the study. Anomalies were found in 68% of patients. The 5 most frequently occurring anomalies in descending order were degenerative joint disease (23.8%), posterior ponticle (13.6%), soft tissue abnormalities (13.5%), transitional segments (9.8%), and spondylolisthesis (7.8%). Fractures (6.6%), malignant tumors (0.8%-3.1%), abdominal aortic aneurysm (0.8%) and atlantoaxial instability (0.6%) were also noted. The authors concluded that a large percentage of patients presenting for chiropractic care have anomalies present on spinal radiographs.</td>
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<td>Hsieh et al.</td>
<td>Not Applicable</td>
<td>A retrospective review of radiographs of 20 lumbar series with lumbosacral transitional segments from a private chiropractic office, 47 lumbar series with lumbosacral transitional segments, and 60 age- and sex-matched control series from a college clinic. The authors found a total of 2.3% of 882 lumbar series at the private chiropractic office and 6.5% of 786 lumbar series at teaching clinic showed lumbosacral transitional segments of types II, III, or IV. The L5-S1 intervertebral disk height was significantly smaller in patients with lumbosacral transitional segments compared with those without (i.e., 11% versus 19% of total lumbar disk height, respectively). When bilateral bony fusion of L5 to the sacrum was present, the L5-S1 disk height was significantly smaller than that without bony fusion (i.e, 8% vs. 12% to 14% of total lumbar disk height, respectively). The rate of occurrence of lumbosacral transitional segments is low in chiropractic practice.</td>
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<tr>
<td>Debono and Marchiori</td>
<td>59-year-old male</td>
<td>A patient suffering from intermittent neck pain is described. Plain film radiographs revealed rarefaction of the C6 spinous process that mimicked an aggressive bone lesion. Computed tomography and previous radiographs of the region confirmed a spina bifida occulta defect of the C6 level. The patient was cared for with supportive therapy for his presenting neck complaint. Chiropractic manipulative treatment was not applied to the lower cervical spine until the possibility of an aggressive bone lesion was excluded.</td>
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<td>Gregerson</td>
<td></td>
<td>The pathogenesis, frequency of occurrence, clinical manifestations and associated abnormalities of spina bifida occulta was examined using Medline, and related texts published after 1989. The author found that the reported frequency of occurrence of spinal bifida occulta varies widely, depending largely on the age groups included in a particular study. The most accurate estimate of occurrence rate was 17% of examined spines.</td>
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Marchiori and Firth\textsuperscript{39} & 32-yr-old female & A patient with a 6-month history of low back pain with intermittent diffuse bilateral leg pain and numbness was described. Plain films of the lumbar spine revealed no abnormality. Magnetic resonance imaging however demonstrated a tethered spinal cord. \\
Menon et al.\textsuperscript{40} & 33-yr-old male & Menon described the care of a patient with low back pain with lumbar and sacral instability with intersegmental flexion-distraction manipulation, and physical therapy with favorable clinical response. Radiographic examination revealed the patient with transitional vertebra. \\
Thomas et al.\textsuperscript{41} & 31-year-old female & A patient with united posterior neural canal elements (T\textsubscript{11}-L\textsubscript{2}) with multiple spasms, poor bladder control and possible immunosuppression is described. The patient was cared for with the Equalizer – a mechanical-force, manually assisted short-lever adjusting procedures, Logan Basic and Applied Kinesiology. \\
Borregard\textsuperscript{42} & 13-yr-old male & A patient with neurogenic bladder, presumably due to spina bifida occulta is described. Absence of bladder sensation was resulted in painful urging and involuntarily voiding. Chiropractic examination found subluxations at the L3 vertebral level and at both SI joints, decreased cranial rhythm impulse with the sacrum fixed in extension. The patient was cared for with Pelvic blocking with Sacro Occipital Technique (SOT) and respiratory assist manipulation (i.e., craniosacral technique) for a period of two weeks. The patient became aware of bladder distension approximately ½ hr before he needed to void.

**Figures**

**Figures 1A and B.** AP and lateral lumbar radiographs. Anomalous posterior arch noted at L5 and S1, inclusive of nonunion the posterior arch elements at these levels (spina bifida occulta). The T12 ribs are absent.
Figure 2. Axial T1-weighted MRI through the S1 posterior arch demonstrating deformity with nonunion of the posterior arch elements at this level.

Figure 3A. Sagittal T2-weighted MRI midline through the lumbar spine (Figure 3B), and axial T2-weighted MRIs at the L2-L3 intervertebral disc (Figure 3C), L4 inferior endplate (Figure 3D), and L5-S1 intervertebral disc. The low-lying conus medullaris is evident, terminating around the L4 inferior endplate (solid white arrows). The normal conus medullaris terminates at the L1-L2 disc level. Fluid-filled elongated cavity (syrinx cavity) is present within the spinal cord (open black arrows) predominantly at L2 and L3. Thickened filum terminale externum is evident (open white arrows).