Segmental Anomaly Leading to Wrong Level Disc Surgery in Cauda Equina Syndrome

Gerard A. Malanga, MD, and Paul M. Cooke, MD

Study Design: A case report of unrecognized lumbarization of the S-1 vertebral body leading to wrong-level disc surgery in a patient with acute cauda equina syndrome secondary to a large disc extrusion at the L4-L5 interspace. Laminectomy and excision were initially performed at the level of L5-L6.

Objectives: To review the importance of detection of lumbosacral transitional vertebrae when performing interventional procedures in the lumbar spine.

Summary of Background Data: Lumbosacral junction transitional vertebrae have been well documented. Likewise, surgery at the wrong intervertebral level has been reported as a reason for failure of lumbar spine surgery. There is also brief mention in the literature of lumbar disc surgery performed at incorrect levels in part secondary to junctional anomalies. However, there is no recorded case of wrong-level disc surgery in acute cauda equina syndrome occurring as a result of an unrecognized lumbarization or sacralization of transitional vertebrae.

Methods: A case report of wrong level disc surgery in a patient with lumbarization of the S-1 sacrum is presented. The literature, clinical course, and imaging studies are reviewed and techniques for detection of transitional vertebral bodies are discussed.

Conclusions: The presence of undetected congenital spinal anomaly, lumbarization of the S-1 vertebral body, resulted in mistaken intraoperative identification of the L4-5 space in this patient resulting in decompression at the wrong level requiring a second surgery. Lumbosacral transitional vertebrae can often be overlooked on plain radiographs and magnetic resonance imaging of the lumbar spine. It is essential to be alert to the possibility of transitional vertebrae when evaluating these imaging studies, particularly in the operative treatment disc disease.

Keywords: Anomalous lumbosacral junction, herniated lumbar disc, transitional vertebra, surgery.

Lumbosacral transitional vertebrae are common congenital anomalies of the spine. Studies have found an overall prevalence ranging from 4% to 8% of the general population (1-4). The role of these vertebrae in the etiology of low back pain is controversial (5). Bertolotti (6) first described the association of back pain and sciatica with lumbosacral transitional vertebrae in 1917. In 1924, Moore (3) concluded that individuals with a sacralization had a liability and should seek an occupation requiring minimal back strain. More recent studies (2,7) have found no association between lumbosacral transitional vertebrae and low back pain.

The relationship between transitional vertebral bodies and intervertebral disc herniation has also been described. In addition, Wigh (10) has reported lumbar disc surgery performed at incorrect levels due to nomenclature errors related to the presence of junctional anomalies. A retrospective analysis of 105 cases of failure or poor result of lumbar spine surgery concluded that surgery at the wrong level was a contributing factor (11). To our knowledge, there is no report in the literature of wrong level disc surgery in acute cauda equina syndrome as a result of a lumbosacral transitional vertebra.

The current report is of a patient with acute cauda equina syndrome secondary to an extruded L4-5 disc that was mistakenly operated on at the L5-L6 level because of an unrecognized lumbarization of the S1 vertebral body.

Case Report

A 34-year-old male with a history of intermittent low back pain was seen in the office by his primary care physician for an exacerbation of back pain and spasm after a four hour car ride. He had no leg radiation and no neurological deficits. This was initially treated with rest and analgesics followed by a trial of physical therapy. The patient's symptoms failed to improve over the course of 2-3 weeks and he underwent magnetic resonance imaging (MRI) of the lumbar spine. This MRI demonstrated a central herniated nucleus pulposus at L4-5 level, small herniation at L5-L6, and the incidental finding of complete lumbarization of S1.

One week after this MRI, the patient awoke with complaints of left leg weakness and numbness of both lower extremities. He reported to the emergency room and was found to have a patchy sensory loss in L5/S1 dermatomes of both lower extremities as well as weakness of ankle dorsiflexors and everters greater on the left than the right. Plain radiographs taken in the emergency room reveal six lumbar-type vertebrae, with lumbarization of the S1 vertebral body (Fig. 1). A Foley catheter was placed and drained approximately 600 mL of urine.

An emergent MRI of the lumbar spine was ordered to rule out cauda equina syndrome. This demonstrated a large extruded disc at L4-5 with significant compression of the thecal sac and a protrusion at L5-S1 (Fig. 2). The patient was brought to the operating room for an emergent laminectomy. He underwent bilateral excision of herniated L4-5 disc with bilateral foramotomies of L4-

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Fig 1. Plain radiographs of the lumbar spine (1A. AP and 1B. lateral) demonstrating six lumbar vertebrae with lumbarization of the S1 vertebral body and a functional scoliosis.

Fig 2. MRI of the lumbar spine with sagittal (2A and axial 2B) views demonstrating a large extruded disc at L4-5 with significant compression of the thecal sac and a protrusion at the L-5-S-1 level. Complete lumbarization of the S-1 level is also noted.
operative image misleading.

terspace. This occurred due to lumbariza-

ter a re-reading of the intraoperative x-ray

called back to the acute care hospital af-

following day. However, at the time of his

and bladder and begin appropriate treat-

ments were made for transfer to a rehabil-

mobilized out of bed to chair. Arrange-

merol for pain every 4 to 6 hours. He was

patient was being given intramuscular De-

consultation and the above findings were

ic bladder.

tinent neurogenic bowel and required an

S4-5 dermatomal regions. He had incon-

brisk at the knee. Sensory exam revealed

es were bilaterally absent at the ankle and

everters or inverters. Deep tendon reflex-

sion facility, his lower extremity motor

five days after the second surgery.

On admission to the rehabilita-

firm lower extremity motor

strength was 3-/5 for bilateral ankle dor-

siflexors and extensor hallucis longus and

trace for bilateral ankle plantar flexors.

sensation was intact through L4 bilater-

ly and was impaired from L5 through S4-

Deep anal sensation was intact and vol-

untary anal contraction was absent. Bul-

ocavernous reflex was absent.

He remained at the rehabilitation

facility for three weeks and continued to

improve. Repeat urodynamic studies re-

vealed an atonic bladder and his bladder

management on discharge was self inter-

mittent catheterizations every 6 hours.

His bowel program was discontinued as

bowel function returned to normal. At

the time of discharge, the patient was am-

bulating with bilateral forearm crutches

and bilateral molded ankle foot orthoses

for 500 to 1000 feet with only distant su-

pervision. He required close supervision

for stairs and distant supervision for func-

tional transfers to the bed, car, tub and

toilet. He was independent in his activi-

ties of daily living. He was discharged to

home with his wife and two children.

DISCUSSION

Congenital anomalies of the spine

such as lumbosacral transitional verte-

brae have been well documented in the

literature (1-4). A study of 4000 consec-

utive patients presenting for low back pain

found a frequency of 6.7% of transition-

al vertebrae on radiographs. A control

operating room and underwent decom-

pression at the L-5 level with excision and

removal of the extruded L4-5 disc frag-

ment. This was confirmed on intraopera-

tive localization x-ray.

By pathology report the disc tis-

sue specimen measured in aggregate 5.0

x 5.0 x 4.0 cm. The patient tolerated the

procedure well. Postoperatively, he con-

tinued to be followed by a physical medi-

cine and rehabilitation specialist and was

placed on a bowel program. Physical ther-

apy was initiated and medications for pain

management were provided. He was also

evaluated by urology. Urodynamic stud-

ies showed a hypotonic detrusor. He was

started on Urecholine and an intermit-
tent catheterization program. He was also

placed on a tapering dose of Decadron.

The patient’s neurologic deficits showed

gradual improvement and he was trans-

ferred back to the rehabilitation facility

five days after the second surgery.

On admission to the rehabilita-

tion facility, his lower extremity motor

strength was 3-/5 for bilateral ankle dor-

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al vertebrae on radiographs. A control

group of 1873 patients had a prevalence

of 5%. An increased incidence was found

in families raising the possibility of a ge-

netic component (14).

The association of low back pain and

lumbosacral transitional vertebrae has

been described, and is known as Ber-

tolotti’s syndrome (6). It has been postulat-
	ed that transitional vertebrae may be as-

sociated with degenerative arthritis of ad-

jacent joints and this may lead to low back

pain (1, 3, 6). However, Frymoyer et al (7)

reviewed radiographs of 321 men with

and without low back pain and found that

those with transitional vertebrae were

equally distributed. In 1997, van Tulder

et al (4) performed a systematic review of

published observational studies and con-

cluded that there is no firm evidence for

the presence or absence of a causal rela-

tionship between the radiographic find-

ing of transitional vertebrae and nonspe-

cific low back pain. However, they found

few studies of acceptable methodology on

this subject. Magora and Schwartz (15)

found no direct relation between sacral-

ization and low back pain in 312 subject

and 148 healthy controls. They could not,

however, comment on lumbarization, which

had an incidence of only 0.64% in

their study. A study of 46 cases of anom-

alous lumbosacral nerve roots found 21% to

have junctional segmental spinal ab-

normalities as well (16).

The association between congenital

spinal anomalies and lumbar disc herni-

ation has been documented in the litera-

ture. There is a high incidence of tran-

sitional vertebrae in children and ado-

lescents with lumbar disc herniation (8).

A review of 70 operative cases of lumbar

disc herniation in children and adoles-

cents revealed twenty with congenital spi-

nal abnormalities including spina bifida,

lumbarization, and sacralization (9). In

1955, Stinchfield and Sinton (17) report-
ed their operative experience in patients

with transitional lumbosacral vertebrae.
They found 30 of 31 disc herniations were

at the level above the congenital anomaly.
This may be the result of increased mo-

tion and stress at that segment. In 60 pa-

tients with myelographic evidence of her-

niated lumbar disc, there was an 83% in-

cidence of herniated nucleus pulposus at

the level cephalad to the transitional seg-

ment. This was only found in incomplete

lumbarization/sacralization type of ver-

tebrae (18). In the case we have report-

ed, the extruded disc at L4-5 was two seg-

Fig. 3. Intraoperative X-ray
ments cephalad to the transitional L6 vertebra, which is uncommon.

Failure of disc surgery immediately following the procedure has occurred due to: insufficient neural decompression, trauma to the nerve root, undiagnosed far lateral recess stenosis, unrecognized instability, persistent lateral; recess stenosis or spinal stenosis, and surgery at the wrong level (19). The actual incidence of wrong level surgery is not known but is probably extremely low. In order to order to help prevent wrong-site surgery, the North American Spine Society developed a campaign that included a checklist referred to as "sign, Mark, & x-ray (SmaX)." Wrong disc level surgery in the case of cauda equina has never been reported and this is understandable, as the pathology in these cases is generally quite clear. In this case, the congenital anomaly of the spine and a disc protrusion at the level below the disc herniation may have been the cause for confusion and the decompression at the wrong level.

Wigh and Anthony (10) reviewed the operative reports and myelogram findings of 42 patients with transitional vertebrae and reported five cases of disc surgery performed at incorrect levels due to nomenclature error. The usual cause for this misidentification is the common practice of counting cephalad from the presumed L5 vertebra at the lumbosacral junction. Hahn (20) has proposed a method to identify transitional segments on MR imaging. Using a cervicothoracic sagittal scout MR image, the total number of vertebral bodies can be determined by counting downward from C2. Assuming seven cervical and 12 thoracic vertebrae allows for accurate detection of a lumbosacral transitional segment. It has also been suggested to identify the right renal artery on T1-weighted paramedian sagittal MR images, as this usually lies at or near the L1-2 disk (21). However, this technique has not been verified in published study.

The importance of identifying lumbosacral transitional vertebrae when viewing imaging studies has relevance, not only to the spine surgeon, but also to the spinal injectionist when performing diagnostic/therapeutic spinal injection procedures. These procedures require meticulous awareness of spinal anatomy and caution particularly in patients with anomalies of the spine.

CONCLUSION

Wrong level disc surgery is uncommon but can result in significant consequences to the patient. One cause for wrong level surgery is congenital anomalies of the spine. These anomalies need to be recognized and carefully identified at the time of interventional procedures such as surgery. Recognition of these anomalies is also of importance to practitioners who perform spinal injections and other spinal procedures.

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