Turkish Neurosurgery 2006, Vol: 16, No: 4, 168-174

Do the Spinal Pathologies that Accompany Lumbar Disc Disease Affect Surgical Prognosis?

Kadir KOTİL
Mustafa ERAS
Mustafa AKÇETİN
Cengiz ACAR
Turgay BİLGE

Department of Neurosurgery, Haseki Educational and Research Hospital, Istanbul, Turkey

ABSTRACT

OBJECTIVE: To the best of our knowledge, a clinical study of lumbar disc pathologies associated with other spinal pathologies has never been published before. We determined clinical, radiological, surgical data, and long term results for cauda equina and conus medullaris syndromes (CCES) due to prolapsed lumbar intervertebral disc with spinal pathology. The relationship between time and surgery has been reported in many articles. The aim of our study was to study the relationship between the surgical effect of CCES and lumbar disc herniation with spinal pathologies.

METHODS: Between 1990 and 2005, 20 patients (12 males and 8 females) with ages ranging from 13 to 75 years (mean 45 years), presented with CCES due to herniated lumbar discs (group A) and lumbar disc with other spinal pathologies (group B). Five (25%) patients had upper lumbar disc herniation (conus medullaris syndrome) and 15 (75%) also had low lumbar disc herniation, both leading to cauda equina syndrome (CES).

RESULTS: The herniation levels were L5-S1 in 5 (25%), L4-L5 in 5 (25%), L3-L4 in 3 (15%), L2-L3 in 2 (10%), L1-L2 in 3 (15%), and Th12-L1 in 2 (10%) patients. Nine (45%) patients had only lumbar disc herniations (group A), while 11 (55%) patients had other spinal pathologies (group B) including high thecal sack in 1, multilevel disc herniations in 5, stenosis in 3, and tethered cord in 2 patients. Eighteen patients had complete, and 2 patients had incomplete incontinence of urine, stool, or both. At presentation, all were urgently examined with conventional myelography, computed tomography (CT) and magnetic resonance imaging (MRI). All patients had been admitted as emergencies with CCES, and underwent laminectomy and discectomy. Follow-ups ranged from 10 months to 6 years. Postoperatively, only 3 cases (33.3%) improved in Group A. Both sensory and motor symptoms were improved in 2 cases. One case had full motor recovery and minor sensory recovery. Group B patients (n=11) with CCES did not improve. The results of this group were unsatisfactory.

Although 3 CCES cases undergoing early surgery showed improvement, cases operated on later did not.

CONCLUSION: If there are additional spinal pathologies, the prognosis is very poor. This unique study had a long follow-up duration. We review the current literature on major neurological deficits (conus medullaris and cauda equina syndromes) and available treatment options.

KEY WORDS: Lumbar disc herniation, spinal pathology, cauda equina syndrome

Correspondence address:
Kadir KOTİL
Hasan Ali Yücel Sokak, Senile Apartmanı, No: 34-14, Çiftehavuzlar, İstanbul 34728, Turkey
Phone: +90 212 5306038
Fax : +90 212 6331003
E-mail : kadirkotil@superonline.com
kadirkotil@gmail.com

INTRODUCTION

The major neurological manifestations of the conus medullaris and cauda equina syndrome (CCES) from lumbar disc herniation usually consist of bilateral sciatica, significant bilateral weakness (especially below the knees), saddle anesthesia/hypesthesia, and incontinence (as a lower motor sign). The incidence ranges from 1 to 10% of all operated lumbar discs (1-10). The role of emergency surgery in improving the outcome of conus and cauda equina compression following lumbar central disc prolapse remains controversial (4-15). It is well known that lumbar disc herniation can cause severe compression of the conus medullaris and cauda equina without other spinal pathologies. But, CCES due to the lumbar disc herniation with spinal pathologies is not well known in the literature. Is early decompressive surgery effective or ineffective in these mixed pathologies?

The goal of this study was to determine whether there was any relationship regarding the existence and non-existence of spinal pathology in patients with CCES between the two groups undergoing surgery, and to determine which group benefited more from the surgery. The overwhelming majority of modern reports concerning this syndrome also state that early diagnosis followed by lumbar laminectomy and discectomy markedly improves the neurological and urological outcome (7-10, 15). We have analyzed our recent experience with patients treated for lumbar disc herniation with spinal pathology who had symptoms of CCES.

PATIENTS AND METHODS

Between 1990 and 2005, 2200 patients underwent lumbar discectomy in the Neurosurgery Department of Haseki Research and Educational Hospital. Twenty (1.1%) of these lumbar discectomies were performed for lumbar disc herniation and severe CCES. These included 12 males and 8 females with ages ranging from 13 (Case 13/Figür 2) to 75 years (mean 45 years). Summary data of the patients is presented for both group A (Table I) and group B (Table II). Nine patients had a history of long-standing back pain and sciatica, while 3 had bilateral anterior thigh pain with lower extremity weakness. Three patients had a history of trauma. One patient had a history of L4-L5 disc surgery (six days before admission). Two patients with an L1-L2 disc had posterior epidural protrusion to the spinal canal (Case 8-10, Figür 1 and 5). One patient with an L5-S1

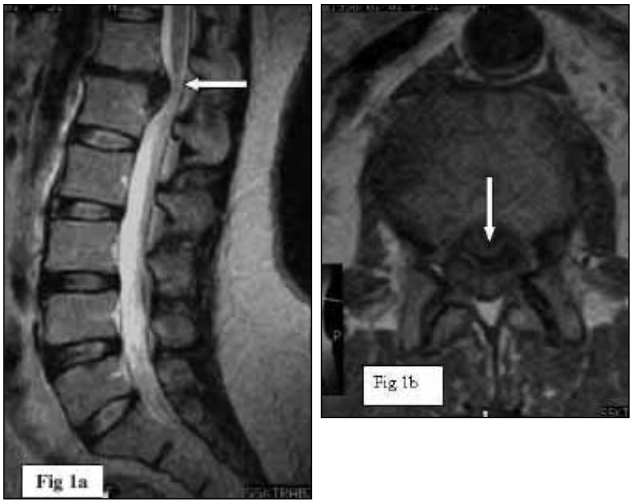

Figure 1: Magnetic resonance imaging of case 18: Sagittal **(1a)** and axial **(1b)** T2-weighted MRI demonstrated complete spinal canal stenosis due to a massive disc herniation at the T12-L1 level. The disc fragment had migrated posterior to the sack (arrows).

Table I: The cases presentation and follow-up time (group A)

Patient No	Age/ Sex	Level of Herniation	Incontinence	Additional Pathology	Surgery Time	Follow-up Time	Outcome
1	53/F	L4-L5	Yes	None	24 h	10.1 mo	Same
2	33/M	L4-L5	Yes	None	24 h	4 y	*Normal*
3	49/M	L5-S1	Yes	None	2 d	3.3 y	*Normal*
4	5/M	L1-L2	Yes	None	24 h	6 y	Same
5	75/M	L1-L2	Yes	None	10 d	19 mo	Same
6	19/F	L2-L3	Yes	None	24 h	8.9 y	Same
7	23/F	L4-L5	Yes	None	24 h	5 mo	*Normal*
8	54/F	Th12-L1	Yes	None	48 h	1.8 y	Same
9	49/F	L2-L3	Yes	None	24 h	9.6 y	Same

Table II: The cases presentation and follow-up time (group B)

Patient No	Age/ Sex	Level of Herniation	Incontinence	Additional Pathology	Surgery Time	Follow-up Time	Outcome
1	23/M	L3-L4	Yes	Tethered	48 h	2 y	Same
2	45/M	L5-S1	Yes	Stenosis	3 d	5 y	Same
3	55/M	L3-L4	Yes	MLDH	4 d	3.9 y	Same
4	56/M	L5-S1	Yes	MLDH	24 h	5.3 y	Same
5	59/M	L4-L5	Yes	Stenosis	2 d	2 y	Same
6	60/M	L1-L2	Incomplete	MLDH	24 h	11 y	Same
7	60/M	L4-L5	Yes	Tethered	24 h	8 y	Same
8	7O/M	Th12-L1	Incomplete	MLDH	7 d	1.4 y	Same
9	13/F	L3-L4	Yes	ALDH	24 h	10 y	Same
10	27/F	L5-S1	Yes	HTS	6 mo	3 mo	Same
11	38/F	L5-S1	Yes	MLDH	1 day	4.5 y	Same

MLDH: Multilevel Disc Herniation ALDH:Adjacent Level Disc Herniation

disc had a high thecal sac and the spinal canal was free under the L5 level (case 16, Figür 3).

There were two groups; Group A (9 patient); patients without spinal abnormalities but with lumbar disc herniation.

Group B: (11 patient); patients with other spinal pathologies.

All patients with upper lumbar disc herniation were unable to stand or walk due to quadriceps weakness. 9 patients with lower lumbar disc herniation were able to walk. Incontinence of stool, urine, or both was present in 20 patients (incomplete in 2 patients). Fourteen patients had histories of weakness and sphincter disturbance increasing gradually over months. Of the 15 patients who developed symptoms of CCES within months, 12 sought immediate medical attention and the other 4 were seen more than 7 days from onset. At presentation, 15 patients with chronic onset were emergently evaluated with radiological imaging when they came to our clinic. Four patients with gradual onset were evaluated electively and were referred to our care. Only 5 of the 20 patients had conventional myelographies (Figür 4), and 5 patients had computed tomography scans (Figür 6). MRI was obtained in only 12 patients.

OPERATION TECHNIQUES

Fifteen patients were urgently operated on admission (in first day). The other 5 were operated 2 days to 6 months after admission. Surgery included hemilaminotomy before discectomy in order to

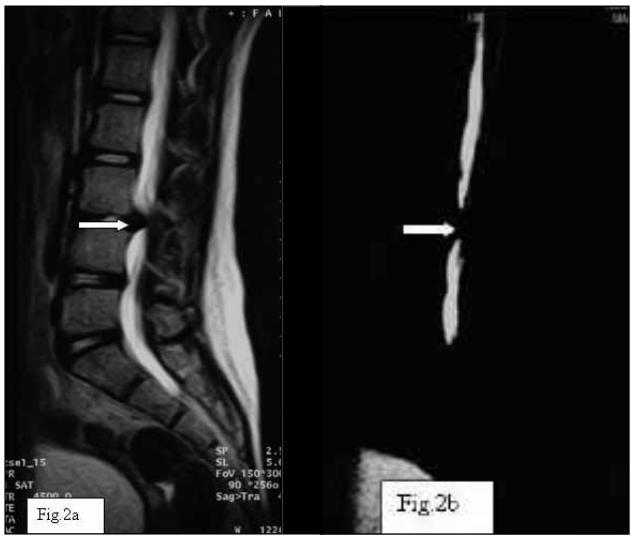

Figure 2: MRI of case 13: **2a:** Sagittal T1-weighted MRI demonstrated complete spinal canal stenosis due to a massive disc herniation at the L3-L4 level. **2b:** MR myelogram demonstrated complete block at the L3-L4 level of the disc space (arrows).

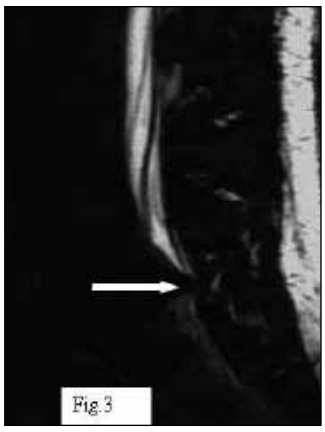

Figure 3: MRI of case 16: Sagittal T2-weighted MRI demonstrated complete spinal canal stenosis due to a massive calcified disc herniation at the L5-S1 level (long arrow) and thecal sack ending at the same level. The sacral spinal canal was free (small arrow).

Figure 4: Case 2: Conventional left oblique myelography demonstrated complete obstruction at the L3-L4 level (arrow).

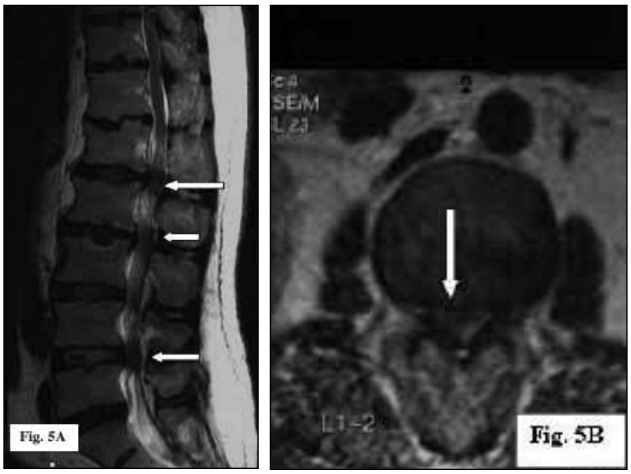

Figure 5: MRI of case 8: Sagittal **(5a)** and axial **(5b)** T2-weighted MRI demonstrated subtotal spinal canal obstruction due to migration posterolateral to the thecal sack at the L4-L5 level and associated multilevel disc herniation (arrow)

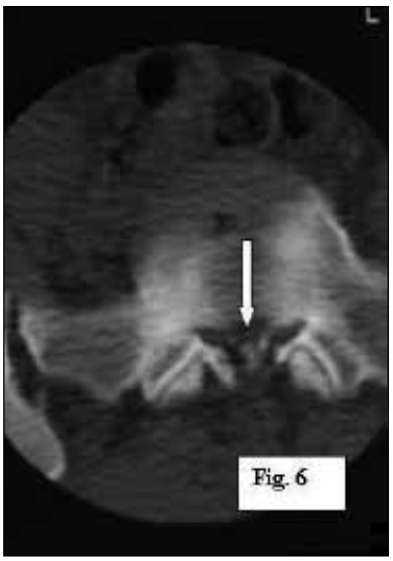

Figure 6: CT of case 17: CT demonstrated subtotal obstruction due to a calcified central herniated nucleus pulposus into the spinal canal at the L5-S1 level (arrow).

facilitate operating on the massive disc herniation. Total laminectomy of upper lumbar vertebrae and complete or massive discectomy were performed in 6 patients. Microdiscectomy was not performed in all cases. Two patients had only laminectomy without discectomy because of posterior epidural penetration of sequestered lumbar disc fragments. Foraminotomies were performed in each stenotic patient treated. We did not section tethered cords.

RESULTS

Fifteen patients (75%) had large or massive disc herniations that occupied more than one-third of the canal diameter, including 2 patients with tethered cord, and 1 patient with a high thecal sack. Two patients had posterior protrusion of sequestered disc fragment into the spinal canal. Five patients (25%) had asymptomatic multilevel disc herniations that were not operated on. Two of the patients with stenosis were aged 45 or more.. One patient had a calcified massive disc herniation with a high thecal sack and spinal MRI revealed a thecal sack ending at the L5-S1 level. Disc herniation occurred in 5 (25%) patients at L4-L5, in 4 (25%) patients at L5-S1, in 3 (15%) patients at L3-L4, in 2 (10%) patients at L2-L3 and in Group B, in 3 (15%) patients at L1-L2, and in 2 (10%) patients at Th12-L1 levels.

Surgical complications including death, dural injury or infection did not occur. All patients were discharged within 3-6 days.

OUTCOME

The follow-up duration ranged from 10 months to 6.1 years (mean 4.9 years). In the end, only 3 (15%) patients who underwent surgery within 48 hours had fully improved. Any patients who had additional spinal pathologies did not improve (group B). Only 3 cases without additional spinal pathologies (group A) showed improvement. Continence was regained in these 3 (15%) patients. Seventeen patients were ambulatory, while 15 patients had complete motor recovery of the legs, but bladder and bowel recovery were more variable and unchanged at the follow-up time (Table III). The main problem in the non-improving cases was their delayed admission, which was true for 85% of our patients.

Information on sexual relations was obtained in 12 patients. Five women operated within 24 hours were sexually inactive before the operation and had unsuccessful sexual intercourse after the surgery.

Table III: The cases presentation and surgery time

	Group A	recovery	Group B	recovery
0-8 hours	-	no	1	no
8-24 hours	6	3	4	no
24-48 hours	2	0	1	no
After the 48 hours	1	0	5	no

Of the 5 women in the early surgery group, only one successfully resumed sexual relations. We did not inquire about orgasm. All of the 7 men in the early surgery group were sexually inactive. None regained sexual activity after surgery, although 5 of them reported that they had erections but not as strong or as often as before.

Seventeen of the twenty patients who underwent surgery within 48 hours of the development of incontinence did not improve. All of the 17 patients, whose incontinence persisted had anal sphincter weakness and saddle anesthesia before surgery. On discharge, all were instructed on self-catheterization to check residual urine volumes. The residual urine volumes ranged from 0 to100 ml 8 weeks after the operation. At the 6th month, all but three patients had stopped the catheterization because the residual urine volume was negligible. Two had persistent residual volumes of 50 ml at the 8th month, and urodynamics revealed slight destructor weakness and dyssynergia. One year after surgery, the residual volumes became negligible; the patients ceased self-catheterization, and refused further urodynamics.

DISCUSSION

Despite documentation of severe compression of the conus and cauda equina dating back to 1909 (13), CCES remains poorly defined. The major neurological manifestation in the lumbar pathologies are variable but most investigators agree that the clinical syndrome is characterized by severe low back pain, unilateral or bilateral sciatica, saddle anesthesia, motor weakness, loss or reduction in lower extremity reflexes, and varying degrees of bladder or rectal dysfunction.

Regarding the pathophysiology, CCES may result from any lesion that compresses cauda and conus medullaris nerve roots or conus. These nerve roots are particularly susceptible to injury, since they have a poorly developed epineurium. When well developed, as in peripheral nerves, they protect against compressive and tensile stresses. The microvascular systems of nerve roots have a region of relative hypovascularity in their proximal third. Increased vascular permeability and subsequent diffusion from the surrounding cerebral spinal fluid supplement the nutritional supply. This property of increased permeability may be related to the tendency toward edema formation of the nerve roots and spinal cord nerves, which may result in edema compounding initial and sometimes seemingly slight injury. Compression or inflammation of the nerve roots can cause symptoms of pain, altered reflexes, decreased strength, and decreased sensation. Although these symptoms can become severe, and in some cases disabling, most are self-limiting and respond to conservative care (3, 4, 11, 15).

Men in their fourth to fifth decade appear to be the most prone to disc herniation with subsequent CCES (1, 4-7, 12, 14, 15). The most often involved disc spaces are L4-L5, followed by L5-S1 and the others. Most cases have a cauda equina syndrome due to lower lumbar disc herniation. Most cases involve a very large mass of disc freely extruding into the canal, occupying more than one-third of the canal diameter. Associated spine or spinal cord abnormalities can limit the canal diameter, predisposing the patient to CCES with a smaller disc herniation, a condition that has been documented in lumbar spondylosis with acquired stenosis and herniated disc compressing directly to conus level.

The proper timing of surgical decompression for CCES is controversial. Although most surgeons recommend urgent decompression, results in certain studies have shown that delayed surgery may provide a satisfactory outcome (1, 2, 6). Most neurosurgeons appreciate the urgency in treating this condition; however, surprisingly little attention has been paid to this problem in the recent neurosurgical literature (1, 3, 5-9, 13-15).

Although CCES due to lumbar disc herniation only comprises 1 to 2% of all lumbar disc operations, most of the busy medical centers treat a few cases a year (7-10). We have operated on 2200 patients in our institution in the last 12 years. Twelve (1.1%) had CCES. Acute trauma is an uncommon etiology for this disorder (14). Approximately 70% of patients have a history of chronic back problems with bilateral symptoms developing with the final

episode of acute CCES (9, 14). Preoperative chronic back pain was associated with poorer outcomes in urinary and rectal function, and preoperative rectal dysfunction was associated with worsened outcome in urinary continence (1). It is important to recognize these patients and treat them conservatively. In more than 85% of the patients, the symptoms and signs of CCES developed in a few hours and included severe bilateral sciatica, bilateral foot weakness, occasional quadriceps and iliopsoas weakness (if the upper lumbar discs were herniated), and urine or stool incontinence or both (1, 3, 4).

The thecal sac usually ends at the S2 level; however, it may occasionally end at a higher level (at L5-S1 in our case 16) and may also press directly on neural tissues or roots. The present study is also the first report presenting a case (i.e., case 16) with both disc herniation and a high-level thecal sack. The tethered cord may simply be a coincidence; however, the low conus medullaris and the thick filum terminale in this patient may predispose to CES. In both our experience and the experience of others, the proper operative technique is a laminectomy for decompression before gentle retraction and discectomy (2, 5, 7-10). A microdiscectomy is not advocated as a small laminotomy followed by excessive manipulation may prove dangerous and has the potential to produce a permanent neurological deficit in the presence of a spinal canal narrowed by the combination of a massive disc herniation and associated spinal pathology such us spinal stenosis, .

In Shapiro's (12-14) experience, 100% of the patients with urine or stool incontinence who underwent surgery within 48 hours of onset, and only 33% of those who underwent surgery after this period regained control. Male sexual function can be affected by prolonged CCES. Though our cases are few in number, early decompression appears to improve the ability to regain or retain erections. Nielsen et al (9) reported that surgery within the first 2 days after the onset of CCES considerably reduced the rate of late bladder abnormalities, compared to surgery after that period. Ahn et al (1) reported that there was a significant advantage in treating patients within 48 hours versus after 48 hours following the onset of CCES. Significant improvements in the sensory and motor deficits as well as the urinary and rectal functions were observed in patients who underwent decompression within 48 hours versus after 48 hours. Kostuik et al (8) advocated surgery within 48 hours, but also believed that the timing of surgery was less important than the severity of the initial problem, which also is an important point deserving elaboration. Four types of bladder symptoms secondary to disc derangement have been described: total urinary retention, chronic long-standing partial retention, vesicular irritability, and loss of desire to void associated with unawareness of necessity to void (6,12).

Motor recovery appears to be essentially complete by the 1st year (1, 5-9). Persistent severe motor deficit was significantly more frequent in the delayed surgery group. Except for the 2 who had bilateral lower extremity weakness, almost all patients regained the ability to ambulate, but the sooner the surgery took place the more likely unassisted ambulation was achieved in the experiences of both Robinson (11) and Shapiro (13-14).

Our cases are few in number, but suggest that early surgery may reduce chronic sciatica. Robinson (11) reported 1 of 17 patients with chronic sciatica, but his follow-up was less than complete. The concept of chronic pain from epidural fibrosis and or arachnoiditis appears to be more prevalent with extensive lumbar surgery (9, 14).

Shapiro et al (12) operated on 14 patients and the results of early surgery warranted treating the clinical syndrome of cauda compression syndrome from lumbar disc herniation as a diagnostic and surgical emergency. Likewise, Kostuik et al (8) also mentioned that 2 patients underwent surgery earlier than 6 hours after onset. It would be very difficult for a patient to present with symptoms of true cauda compression syndrome and undergo radiography and surgery within 6 hours as this is not a life-threatening problem. Gleave (5, 6) et al., and Delamarter et al. (4) also believed that the timing of surgery was less important and there was no correlation between recovery and the duration of bladder paralysis before surgery, except in three patients in whom there was no sciatica and where the correct diagnosis was delayed for many days.

The concept of chronic pain from an excessive delay of disc surgery, which is attributable to neural damage, intraneural fibrosis, or altered behavior patterns, is also well known (13). Every effort should be made to operate within 24 to 48 hours of onset.

Additionally, we counsel all patients with less severe problems of disc disease to report any problems with bilateral weakness and incontinence urgently, in order to prevent delay in treatment. However, our experience has shown that early diagnosis and treatment does not improve the outcome of this uncommon massive disc herniation if it is accompanied by spinal abnormalities such as stenosis, cord tethering, multilevel disc herniation, and low-lying conus medullaris or high thecal sack. Three of nine cases lacking other spinal pathologies had improved. But these patients had low-level lumbar disc herniations. Our patients with upper level lumbar disc herniations, regardless of other spinal disorders, also did not improve.

In conclusion, the results of this study further substantiate the concept that the CCES is a diagnostic and surgical emergency with high morbidity. Early diagnosis and operation within 48 hours could not reduce morbidity. The incidence of CCES was relatively high in our group B series, and we believe that the management of this group is very difficult compared to group A which includes only lumbar disc herniation without additional spinal pathologies. We believe that the prognosis is very poor in patients who have both lumbar disc herniation and additional spinal pathologies.

REFERENCES

1. Ahn UM, Ahn NU, Buchowski JM. Cauda equina syndrome secondary to lumbar disc herniation: a meta-analysis of surgical outcomes. Spine 2000:15;25(12):1515-22.
2. Bartels R, de Vries J. Hemicauda equina syndrome from herniated lumbar disc: a neurosurgical emergency? Can J Neurol Sci 1996:23;296-9.
3. Choudhury A, Taylor J. Cauda equina syndrome in lumbar disc disease. Acta Orthop Scand 1989:51;493-499.
4. Delamarter RB, Sherman JE, Carr JB. Award in experimental studies. Cauda equina syndrome: neurologic recovery following immediate, early, or late de-compression. Spine 1991:16(9);1022-9.
5. Gleave J, MacFarlane R. Prognosis for recovery of bladder function following lumbar central disc prolapse. Br J Neurosurg 1990: 4;205-9.
6. Gleave JR, Macfarlane R. Cauda equina syndrome: what is the relationship between timing of surgery and outcome? Br J Neurosurg 2002: 16(4);325-8.
7. Jones DL, Moore T. The types of neuropathic bladder dysfunction associated with prolapsed lumbar intervertebral disc, Br J Urol 1973:45(1);39-43.
8. Kostuik J, Harrington I, Alexander D, Rand W, Evans D. Cauda equina syndrome and lumbar disc herniation. J Bone Joint Surg [Am] 1986:68;386-391.
9. Nielsen B, de Nully M, Schmidt K. An urodynamic study of cauda equina syndrome due to lumbar disc herniation. Urol Int 1980:35;167-170.
10. Oppenheim H, Krause FUeber Einklemmung bzw: Strangulation der cauda equina. Dtsch Med Wochenschr 1909: 35(16);697.
11. Robinson R. Massive protrusions of lumbar discs. Br J Surg 1965:52;858-865.
12. Shapiro S. Cauda equina syndrome secondary to lumbar disc herniation. Neurosurgery 1993: 12;743-746.
13. Shapiro S. Cauda equina syndrome secondary to lumbar disc herniation. Neurosurgery 1993: 42:8;463-478.
14. Shapiro S. Medical realities of cauda equina syndrome secondary to lumbar disc herniation. Spine 2001: 25(3);348-5.
15. Smith S, Leibrock L, Gelber B. Acute herniated nucleus pulposus with cauda equina compression syndrome following chemonucleolysis. J Neurosurg 1987:66;614-617.