

Timing of Surgery in Bladder Functional Outcome of Cauda Equina Syndrome of Lumbar Disk Disease: A Prospective Study

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ABSTRACT

Objectives: Cauda equina syndrome (CES) is a complex of clinical symptoms/signs secondary to prolapsed intervertebral disk. The clinical presentation depends on varying combinations of lower extremity weakness, sensory loss in the lower extremities and/or saddle area, pain in the low back and/or lower extremities, and visceral impairment of bladder, rectal and/or sexual function. Although CES is sometimes used to describe a syndrome without impairment of bladder and bowel function, generally in the literature the term 'cauda equina syndrome' means a syndrome that includes impairment of urinary function and saddle sensory deficits.

Materials and methods: We have taken all the discogenic CES cases that presented to the Department of Neurosurgery at Gauhati Medical College and Hospital for a period of 2 years. All the patients were subjected to thorough clinical evaluation and requisite investigations specifically magnetic resonance imaging (MRI). All underwent surgery followed by analysis of the surgical outcome.

Results: Out of the total of 30 patients, male outnumber female, maximum incidence being 4th decade, age incidence ranging from 17 to 70 years. Clinically, patients presented with history of recent onset and an earlier less well-defined history of pre-existing symptoms. Low backache being the most common symptoms followed by radiculopathy, saddle anesthesia. Urinary straining/retention was the most common autonomic disturbance followed by incontinence urinary function outcome was poor in two patients, fair 10 patients, normal 18 patients. Time interval to surgery after autonomic involvement range from 5 to 200 days, mainly due to delayed referral. The most common level was L4-L5 followed by L5-S1, laminectomy single level done in 17 cases, fenestration one cases followed by discectomy.

Conclusion: Surgical intervention should be done in CES irrespective of the duration and severity of clinical symptom and autonomic symptoms. Timing of surgical intervention from autonomic involvement does not affect outcome. It is the severity of deficit which is the major determinant of outcome.

Keywords: Autonomic, Cauda equina syndrome, Discogenic.

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INTRODUCTION

'Thou cold sciatica cripple our senators that their limbs may halt as lamely as their manner'—Shakespeare.

The term 'sciatica' has been used by Hippocrates and Shakespeare refers to it in *Timons of Athens*. In 1929, Schmorl along with Junghans carried out pioneering studies, and presented the modern concept of intervertebral disk disease. Dandy described in 1942, the first case of intrathecal disk prolapse in the region of the cauda equina. Massive disk prolapse with partial or complete obliteration of spinal canal occurs in about 10% of cases and is more common at L3-L4 and L4-L5 levels than at L5-S1 level.

Sciatica management due to intervertebral disk protrusion most commonly involves a choice between conservative measures or in perhaps 10% of patients, surgical.

There is, however, a group of patients, small in number but of great importance, in whom operative treatment is not merely an option but an imperative, and in many instances an emergency imperative and these are the patients in whom central or paracentral rupture of an intervertebral disk results in compression of the cauda equina.

Cauda equina syndrome (CES) is a complex of clinical features most commonly secondary to a massive prolapsed intervertebral disk.¹ Although the clinical presentation varies according to the involved nerve roots, it includes varying combinations of lower extremity weakness, sensory loss in the lower extremities and/or saddle area, pain in the low back and/or lower extremities, and visceral impairment of bladder, rectal, and/or sexual function. Generally in the literature, the term 'CES' means a syndrome that includes impairment of urinary function and saddle sensory deficits.^{2,3}

Podnar⁴ found an annual incidence of CES from intervertebral disk herniation of 1.8 per million in Slovenia. Extrapolating to the annual incidence of herniated disks

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in the US (150 per 100,000), he calculated that 0.12% of herniated disks in the US result in CES.

Tandon and Sankaran⁵ described the ways in which CES can present: suddenly, over a period of a few hours, either as the first sign of lumbar disk pathology (Type I) or as the end point in a long history of chronic low back pain and/or sciatica (Type II); or slowly and insidiously, progressing gradually to severe visceral impairment with urinary retention (Type III).

Problems arise in perceived delay in management and there are a variety of opinion regarding the optimum timing of surgery.⁶⁻¹² Most publications has been retrospective with a limited number of patients and inconsistent follow-up intervals. Majority of the studies suggest that CES due to herniated disk requires surgical treatment on an urgent basis.¹³⁻⁴³ However, not all studies support this arguing that the principal determinant of outcome may not be the timing but the extent of neurological deficit prior to surgery.^{7,8}

AIMS AND OBJECTIVES

To study the urinary bladder functional outcome of surgery.

MATERIALS AND METHODS

The present study is a prospective study carried out in the Department of Neurosurgery, Gauhati Medical College and Hospital, Guwahati for a period of 2 years. A total of 30 nontraumatic discogenic cauda equina syndrome patients admitted at Department of Neurosurgery who were operated were included in this study.

Basic demographics were prospectively gathered on all patients. All patients underwent MRI scanning prior to surgery (Figs 1 and 2). The time from symptoms to referral to surgery was noted. Follow-up, at a mean of 3 months and 2 years, involved urinary outcome

assessment using three categories normal, fair, poor as used by Delong et al.

In their original paper, Gleave and Macfarlane⁴³ classified urinary outcome as 'excellent if full bladder control was regained within 6 weeks, good if recovery was ultimately full but delayed, fair if the patient had voluntary control but suffered from stress incontinence or lack of urinary sensation, and poor if they remained incontinent.'

In the current study, we use three categories of urinary outcome: normal, fair and poor, with normal including the two groups that Gleave and Macfarlane called 'Excellent' and 'Good.'

This system of grading urinary outcome depends upon the patient's subjective perception of bladder function and does not necessarily express the true neurological status of the bladder, since many patients with bladder dysfunction may void by using abdominal straining, unaware or only marginally aware that they are doing so.^{13,22,44} However, since few studies report the results of postoperative urodynamic evaluation, we chose this system for the purposes of this analysis.

Therefore, 'Normal' means the patient perceives his or her urinary function to be normal; 'Fair' means the patient has some degree of difficulty with urination, such as having to strain actively to void, having stress or nocturnal incontinence, or having signs of abnormal postvoiding residual urine, such as urinary frequency or frequent urinary infections; and 'Poor' means the patient requires catheterization, either intermittent or indwelling, or requires the constant use of pads or absorbent undergarments. We also considered the outcome as 'Poor' if the patient had persistent incontinence of stool or flatus.

For a diagnosis of CES, we have concluded that one or more of the following must be present: (1) bladder and/or bowel dysfunction, (2) reduced sensation in the saddle area, or (3) sexual dysfunction, with possible



Fig. 1: Magnetic resonance imaging T2 sagittal section showing extruded disk at L4-L5 level

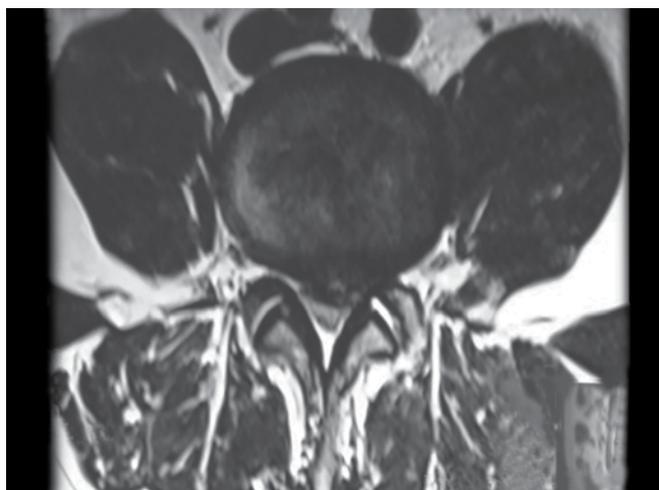


Fig. 2: Magnetic resonance imaging T2 axial section showing extruded disk on left

neurologic deficit in the lower limb (motor/sensory loss, reflex change).

The time-to-surgery was calculated as the time that the patient initially complained of urinary retention and/or incontinence till the time that the surgery began.

Exclusion Criteria

- Cauda equina compression due to spinal canal stenosis
- Crush injury of lumbar spine with associated disk disruption causing CES.

RESULTS AND OBSERVATION

The present study is a prospective study carried out in the Department of Neurosurgery, Gauhati Medical College and Hospital, Guwahati for a period of 2 years. A total of 30 nontraumatic discogenic CES patients admitted at Department of Neurosurgery who were operated included in this study.

As the sample size was small in number no comparable results were drawn statistically in this study.

All the patients met the criteria taken by us to constitute CES.

Age Distribution

The mean age of presentation was 41.3 years with a age range from 17 to 70 years. Maximum incidence was in the 4th decade (Graph 1).

Onset of Symptoms

Though we have classified the onset of low backache in three categories, we found out that patients with Type I onset was 1 in no, and Type II onset was 28 in nos, and 1 patient did not suffer any low backache.

None of our patients presented with only autonomic involvement (Graph 2).

Autonomic Dysfunction

Urinary dysfunction in the form of urinary difficulty, altered urinary sensation, loss of desire to void, poor urinary stream, and the need to strain during micturition was present in 25 patients and urinary incontinence was present in five patients. Preoperatively 12 patients required catheterization. At follow-up postoperatively only two patients were on catheter till the end of the study.

Time from Onset of Urinary Symptoms to Surgery

All the patients had some form of urinary dysfunction. The patients were operated at a mean duration of 68.47 days from the onset of urinary symptoms, with a time range from 5 to 240 days. All the patients were operated in the next available list by a surgeon not below the rank of Assistant Professor (Graph 3).

Level of PIVD (CES)

- L3-L4 = 2 patients
- L4-L5 = 17 patients
- L5-S1 = 11 patients

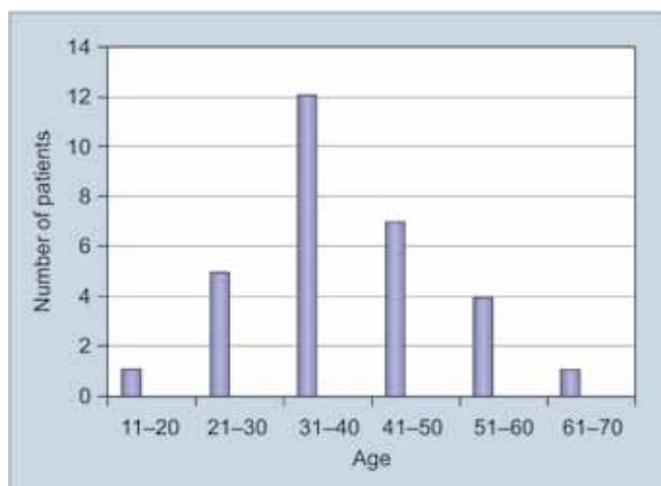
Total numbers of patients with lumbar disk disease = 102.

Laminectomy

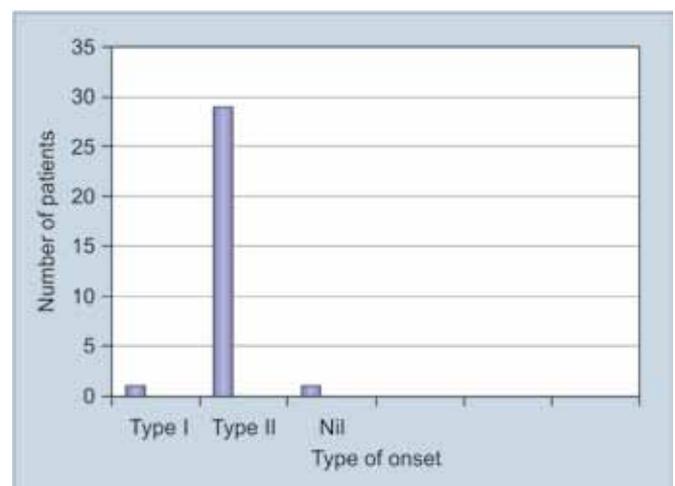
- Single level 24
- Two level 5
- Fenestration 1 (Graph 4).

DISCUSSION

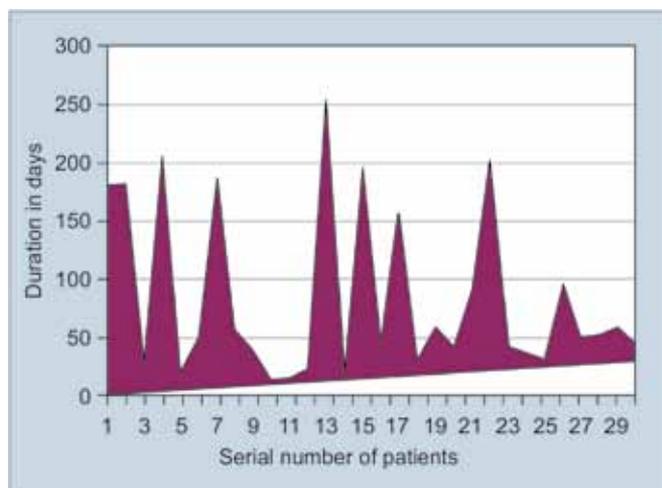
The definition of CES is still controversial, with subclassifications into complete and incomplete, total and partial, full-blown, classic, true and hemi-CES. When CES has been defined by clinical presentation, it can be global—



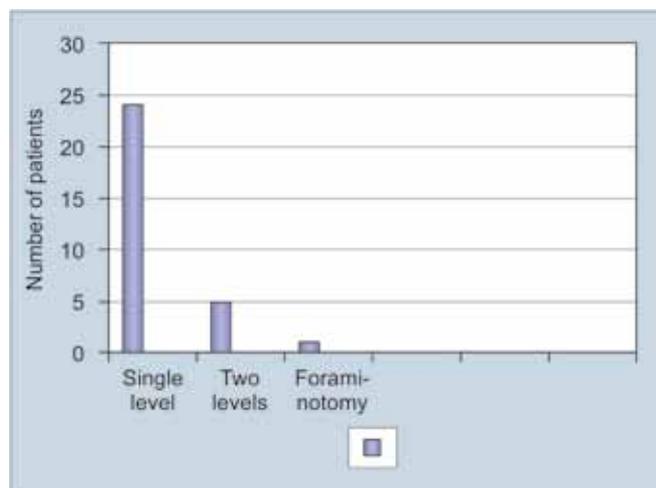
Graph 1: Bar diagram showing age distribution



Graph 2: Type of onset of symptoms



Graph 3: Time from onset of urinary symptoms to surgery



Graph 4: Level of laminectomy

for example, a 'loss of function of the bowel, bladder and sexual function,⁴⁹—or more specific, such as 'retention of urine or dribbling incontinence accompanied by saddle sensory loss and anal sphincter flaccidity.⁵⁰ There are also less severe presentations suggesting that it is impossible to derive a single definition of CES because of varying severity and presentation.

However for the diagnosis of CES, we have concluded that one or more of the following must be present: (1) bladder and/or bowel dysfunction, (2) reduced sensation in the saddle area, or (3) sexual dysfunction, with possible neurologic deficit in the lower limb (motor/sensory loss, reflex change).

Cauda equina syndrome is rare and is estimated to account for fewer than 1 in 2000 of patients with severe low back pain.⁵¹ Nevertheless the presence of CES is reported in 1 to 16% of lumbar disk herniations³ and 2 to 3% of all patients with herniated disks who require surgery.⁸ In our series, we found an incidence of 29.4% of CES from among the patients presenting with lumbar disk disease who required surgery in our hospital.

While the disk has been identified as the most prevalent cause of CES and the majority view for affecting a specific location was sensation. However, the specific location of sensory alterations vary considerably across the literature and three quarters of patients with CES present with anesthesia of the perineum and saddle area.⁵² Loss of sensation in the saddle distribution is said to be the most striking feature of CES when found in conjunction with sphincter disturbances.⁵³ Complete perineal anesthesia at presentation is considered indicative of poor prognosis, with residual sphincter dysfunction postsurgery.²⁷

Motor dysfunctions within the literature included generalized descriptions, such as 'hypotonic legs'⁵⁴ or 'lower extremity motor weakness',⁵⁵ and specific 'persistent weakness of ankle plantar flexion in both feet.'³ and

bladder/rectal function. Most reports indicate that motor function usually recovers well which is related to the fact that the lesion is distal to the cells of origin of the motor axons in the conus medullaris and theoretically recovery should take place, as it does in more peripheral nerve lesions provided irreversible destruction of the axons has not occurred. The same may be said of the autonomic efferent axons to the bladder which travel in the second, third and fourth sacral roots. Thus, recovery of the bladder detrusor is theoretically achievable. However, the afferent axons, both somatic and autonomic, in the cauda equina have their cells of origin in the posterior root ganglion; the compressive lesion is, therefore, proximal to these nerve cells and the possibilities of recovery are very dependent on the conduction status of these central axons at the time of operating. Functional recovery can occur only if the compression is of the same order as a neuropraxia in peripheral nerve injury. Alternatively, irreversible degeneration of the compressed axons may only affect a portion of the nerve root in contact with the disk sequestrum, leaving sufficient functioning axons to regain reasonable bladder function when the compression is relieved. Given, however, the crucial importance of intact sensation for normal bladder and rectal function, at least 90% of autonomic afferent axons to be functioning to achieve clinically adequate bladder and rectal control. It is also interesting to observe that it has been postulated that sacral nerve root function may be spared in some cases on account of the greater length of the more centrally situated sacral nerve roots resulting in more slack in the sacral roots.⁵⁷ Another factor favoring recovery in bladder function is that these structures are only a centimeter or so from the ventral surface of the sacrum and its anterior intervertebral foramina. Arguing from the well-known observation that in peripheral nerve injuries recovery is usually more satisfactory in muscles nearer to the lesion than in those further away and likewise that sensory

re-innervation appears last of all in distal areas one could postulate that bladder and rectum and anal canal are favorably located for recovery.

Similarly, in the study by Tullberg and Isacson⁵⁶ of 19 patients with CES (and normative lumbar myelography), only nine patients were reported to have any weakness in the lower limb; therefore, it is apparent that weakness may be minimal if present at all in CES, and while apparently less important in the clinical presentation than bladder or bowel dysfunction.

Urinary disorders usually follow or accompany more obvious neurologic symptoms that allow a proper diagnosis to be made. But sometimes voiding disturbances may be the only or the first symptom of central lumbar disk prolapse, and the diagnosis of cauda equina compression becomes more difficult.^{33,36,60,72} None of our patients had only urinary retention at presentation, although they had a history of lumbar pain for months. Although the recovery of voiding function after central disk prolapse has been reported to be uncommon and most patients are left with an acontractile detrusor Scott, 1965^{60,62,63,71,73} some reports have obtained good results after surgery for lumbar disk prolapse.⁶⁴⁻⁶⁹ Emergency surgery has been reported to be important to increase the chances of satisfactory neurologic recovery in patients with central lumbar disk prolapse.^{10,60,70} However, the timing of surgical decompression for urinary retention or CES is controversial. The early studies reported that the preoperative duration of urinary retention should be within a few days to 2 weeks for the recovery of voiding function^{9,13,40,65} whereas other authors have reported that the interval between the onset of the syndrome and surgical treatment does not affect the outcome.^{25,33,43} Gleave and Macfarlane⁴³ in the year 1990 stated, 'There is no evidence in the literature to support the view that urgent decompression has any bearing upon clinical outcome.' And in our series of 30 patients, we found no correlation between recovery and duration of bladder paralysis before surgery. However, Shapiro in 2002 analyzed 44 patients; 18 of whom were operated within 24 hours and 2 within 48 hours. These patients did statistically better than those operated on later. But Buchner and Schiltenswolf¹⁶ in the year 2002 reported on 22 patients with CES and found no statistically significant difference concerning the time between onset of symptoms and surgical decompression and subsequent outcome.

These divergent findings from previous series offer several explanations. Authors use different criteria to decide which patients have CES, making comparison difficult. Some authors feel that the acute onset of the symptoms is more important than time-to-surgery,

whereas other do not.^{16,23,58} The patient populations are heterogeneous and follow-up varies widely among the different reports. The degree of bladder dysfunction before surgery probably varies from patient to patient, some being complete, others incomplete.⁸ Many authors have reported patients whose bladder difficulties have resolved after years of follow-up.⁴⁸ However, these studies do not include the recovery of lower urinary tract function based on urodynamic data.^{61,62} Reported unchanged bladder function after surgery in patients with acontractile detrusor in lumbar disk prolapse, although they excluded patients with CES due to central disk prolapse. At follow-up, 65% of his patients still had acontractile detrusor but 10 of 17 recovered electromyographic activity in the pelvic floor, indicating that detrusor function was irreversible, whereas urethral function showed a better recovery.

All of our patients underwent surgery within next available date of presentation to us. They presented to us in a range of 5 to 240 days after their autonomic disturbances. Since majority of the people sustain their livelihood as agriculturist, they generally carry on their day-to-day activity and report only when they are incapacitated. Moreover, those presenting with autonomic disturbances secondary to low backache are referred initially from periphery to an urologist for their urinary problems.

It is, also apparent that the recovery of bladder function after CES seems to be mediated by different mechanisms. Some patients seem to recover reinnervation, whereas others seem to void using abdominal straining. However, most series do not report preoperative and/or postoperative urodynamic studies.¹⁶ The series that do typically demonstrate better recovery of bladder function by urodynamic studies in those patients operated sooner than later.⁵⁹ However, this does not seem to have any functional significance. The majority of the series rely upon the patient's report of how well they were voiding. Although earlier reports showed poor results for return of bladder function on long-term follow-up, the more recent reports demonstrate that there is a good probability for return of function.^{16,43,45,47} In our series, urinary dysfunction in the form of urinary difficulty, altered urinary sensation, loss of desire to void, poor urinary stream, and the need to strain during micturition was present in 25 patients and urinary incontinence was present in five patients. Preoperatively 12 patients required catheterization. At follow-up postoperatively only two patients were on catheter till the end of the study.

From very early reports on the treatment of patients with CES, the general consensus has been that a wide laminectomy is necessary for a good result. For example,

Gleave and Macfarlane⁴³ stated that surgical exposure should generally be via full laminectomy. Contemporary authors, such as Sharpiro^{11,45} have expressed similar opinions. However, Chang et al⁴⁸ report bilateral partial hemilaminectomy in some of their patients. Hussain et al⁴⁶ also reported bilateral laminectomy and discectomy. Therefore, we feel that a bilateral laminectomy and discectomy is frequently all, i.e. needed to adequately and safely remove these large herniations. As commented on by Dinning and Schaeffer,¹⁷ who advocate full laminectomy, it is important to avoid compression of the dura and its contents with bone punches and rongeurs.

CONCLUSION

Our study of 30 cases, though a small number was done with an attempt to assess the characteristic symptoms and surgical outcome of CES. We have found that patients present with diverse symptoms not typical to definition of textbook and that the duration of autonomic disturbances till surgery has no implication in the outcome in our study. In long follow-up sensory/motor symptoms do recover as also bladder function.

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