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# Cauda equina syndrome: evaluation of the clinical outcome

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**Abstract. – AIM: Cauda equina syndrome is a rare but highly impairing syndrome involving lower limbs as well as urinary, defecatory and sexual function. In the literature the most investigated sphincter dysfunction is the urinary. Bowel and sexual function are often overlooked since they become more relevant after the acute phase.**

**PATIENTS AND METHODS: Eight consecutive male patients affected by cauda equina syndrome with sphincter dysfunction due to herniated disc disease of lumbar spine were treated between 2007 and 2009. Five patients were followed-up for at least two years. Sexual function was evaluated by IIEF-5 questionnaire; bowel function was investigated by means of clinical and instrumental investigation and manometry.**

**RESULTS: Although little clinical improved, patients still complained severe symptoms at first year follow-up while all but one improved significantly in the following year. At two years follow-up only the patient whose cauda equina syndrome was misdiagnosed and surgically treated late respect to the onset of the syndrome, complained a persistent severe sexual and bowel dysfunction.**

**CONCLUSIONS: Our results show that a long-term follow-up is mandatory to evaluate the real outcome of surgical managed cauda equine syndrome because short-term evaluation could be misleading about the residual capacity of late neurologic improving. Despite the relatively low number of cases evaluated, our results confirm that early diagnosing and treating the syndrome are relevant for the final outcome.**

*Key Words:*

*Cauda equina syndrome, Herniated disc disease, Erectile dysfunction, Bowel dysfunction.*

## Introduction

Injury of the nerve roots of the cauda equina is the most frequent cause of a neurologic disability syndrome that involves urinary, defecation and sexual functions. A persistent neurologic impairment, although generally improved after the onset of the syndrome, is a condition that strongly affects patients' quality of life and restricts their social activities. Any cause that determines compression of the sacral nerve roots inside the lumbosacral vertebral canal can potentially cause irreversible damage to the neurologic structures. The complexity of the neurologic anatomy of the region explains the variety of clinical disabling pictures among which urinary dysfunction is the most evident. As urinary dysfunction is the first appearing symptom soon after roots compression it received greater attention in literature compared to defecation dysfunction that develops slower or sexual dysfunction that becomes evident only when the patient regains a normal life. Although often underestimated by clinicians, the impairment of a normal defecation or sexual life can be very uncomfortable for patients. Especially for younger patients the impossibility to have normal sexual relations is the major cause of psychiatric symptoms such as depression or self-underestimation.

Between 2007 and 2009 we treated 8 patients all affected by herniated lumbar disc disease that were admitted to our institution for acute cauda equina syndrome with sphincters dysfunction. All patients underwent neurologic decompression and were followed up at least for two years to evaluate clinical recovery. In our survey particular attention was focused on the more neglected defecation and sexual dysfunctions. Aim of this observational study was to evaluate sexual and anorectal functions in Cauda Equina Syndrome (CES) patients.

## Patients and Methods

In the short time of 15 months, between the end of 2007 and the beginning of 2009, we observed and treated 8 consecutive male patients



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affected by cauda equina syndrome due to herniated disc disease. Although in the same period we treated acute syndromes of roots compression by different causes, especially traumatic and neoplastic, we decided to consider only the syndromes due to herniated disc because they represent a quite homogeneous series. All patients were referred to our hospital for lower radiculopathies and urinary retention. None of the cases treated was diagnosed before the hospital admission because of misinterpretation of the symptoms. The lack of women in our series was not a deliberate choice but only the consequence of the case because no female patient with cauda equina syndrome due to herniated disc disease was treated in our institution in the period took into consideration.

All patients underwent decompressive laminectomy and removal of the herniated disc except two cases in which a stabilization of the level by pedicles screwing was performed to avoid further instability due the wide laminectomy carried out.

Five patients (mean age 44.8, min 22-max 60) out of 8 patients underwent decompression were submitted to a complete clinical evaluation trough administration of SF-36, validated IIEF-5 questionnaires and colo-rectal evaluation. Of the remaining patients we have only incomplete follow-up data; one patient refused the investigative procedure and two went back to their countries of origin few months after the operation being foreign workers. To evaluate sexual function we administered the International Index of Erectile Function (IIEF-5), a psychometrically valid and reliable questionnaire to investigate erectile dysfunction based on five sexual function domains: erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction[1]. The questionnaire is divided in 5 items which of them allows five possible answers from 1 to 5 according to the grade of dysfunction. The severity of the dysfunction is finally expressed as a value that is the sum of the answers to the five items. The cut-off value to distinguish between erectile dysfunction (ED) patients and those who have not ED is 21 score (normal value 22-25). The remaining four severity categories are as follows: severe (5-7), moderate (8-11), mild to moderate (12-16), and mild (17-21).

The colo-rectal evaluation was made by colorectal surgeons of the same institution and consists of a complete medical history, focused particularly on the symptoms of defecation disorders (frequency of bowel movements, evacuation efforts, anal pain, incomplete evacuation feeling, rectal discriminative ability, fecal incontinence and soiling, assistance with laxatives, enemas or manual manoeuvres, chronic idiopathic constipation index (CICI), urinary disorders, clinical evaluation, physical examination (including digital examination and anoproctoscopy), and anorectal manometry (ARM).

The CICI is a scoring system designed to quantify the severity of the constipation and, thus, standardize findings between different patients, before and after therapy. It is based on seven different variables (number of spontaneous defecation, use of laxative, use of enema, abdominal pain, abdominal distension, autonomic neuropathy or associated gastrointestinal motility disturbance, and working ability), each scored from 0 to 3 according to their severity, with a total range from a minimum of 0 (no constipation) to a maximum of 21 (the worst constipation)[2].

ARM was performed using a water-perfused catheter with four radially aligned channels attached to a hydraulic capillary infusion system. The catheter was 4.5 mm in diameter with sideholes of 0.8 mm in diameter. Examination was performed in left lateral position with manual pull-through technique. Enema before examination was mandatory. The following variables were recorded: maximum resting pressure (highest pressure along the functional anal canal), mean resting pressure, maximum squeeze pressure, ano-rectal pressure during bearing down/defecatory maneuvers (normal/dissynergic pattern), the presence of cough reflex, the presence of recto-anal inhibitory reflex (RAIR), and rectal sensation (threshold for first sensation, threshold for desire to defecation and maximum tolerated volume)[3] (Table I and Figures 1). These parameters were analyzed using data collected in Polygram software.

## Results

Herniated disc disease was localized at L5-S1 level in 2 cases, L4-L5 in two cases while in one case the herniated disc was combined with high grade L4-L5 degenerative stenosis (Table II).

Even though establishing with confidence the true onset of the symptoms was not possible an attempt was made to investigate the delay of the diagnosis based on the clinical history reported by the patient. Two patients reported symptoms

**Table I.** Clinical meanings of anorectal manometry parameters.

| Manometric parameters | Clinical meaning |
|---|---|
| Maximum resting pressure (mmHg) | Maximum pressure value in the anal canal under resting condition |
| Mean resting pressure (mmHg) | Mean pressure value in the anal canal under resting condition |
| Squeeze pressure (mmHg) | Maximum pressure value in the anal canal under squeezing condition (as a difference between maximum value during squeeze and maximum value during rest) |
| Defecation pattern | Qualitative evaluation of contractility pattern displayed by voluntary anal sphincter (categorized in either normal or dyssynergic) |
| Cough test | Presence/absence of anal pressure variation under the Valsalva manouver |
| Recto-anal Inhibitory Reflex (RAIR) | Presence/absence of anal pressure variation elicited by fast inflation of a balloon placed into the rectal ampulla |
| Threshold for Rectal First Sensation (ml) | Threshold of first constant rectal sensation elicited by slow inflation of a balloon placed into the rectal ampulla |
| Threshold for desire to defecation (ml) | Threshold of first defecatory desire elicited by slow inflation of a balloon placed into the rectal ampulla |
| Maximum Tolerable Volume (ml) | Maximum volume value tolerated by the patient before lack of feces as elicited by slow inflation of a balloon placed into the rectal ampulla |

less than 24 hours, one patient longer than 24 hours but less than 36 hours and two more than 48 hours. It was also evaluated the time between the admission at the hospital and the operation and, in all cases it was less than 6 hours except one case who was treated 12 days later.

All five patients who completed colo-rectal examinations answered to the IIEF-5 at one and more than 2 years follow-up (two patients were followed up more than three years); one of them affirmed some degree of preexisting erectile dysfunction and regular use of local injection of prostaglandin (PGE-1) for some years before the operation. He was suffering of long time diabetes with bad control of glycemia. IIEF-5 mean value at one-year f-up was 6.2 (min 3-max 8, SD=1.92), at more than two years was 15.4 (min 7-max 24, SD=6.27) (Table III). At the first clinical control one year after operation, all patients complained a high grade ED (four severe and one moderate) while, two-year later, all patients except one who did not improved, had a substantial improvement of at least one category (one patient regained complete sexual ability)

Sf-36 at one-year follow-up was 41,2 for ISF (range 34-51, SD = 6.76) and 39.6 for ISM (range 22-50, SD = 11); at 3 year follow-up was 47,4 for ISF (range 35-55, SD = 8.61) and 45.8 for ISM (range 29-60, SD = 11.1).

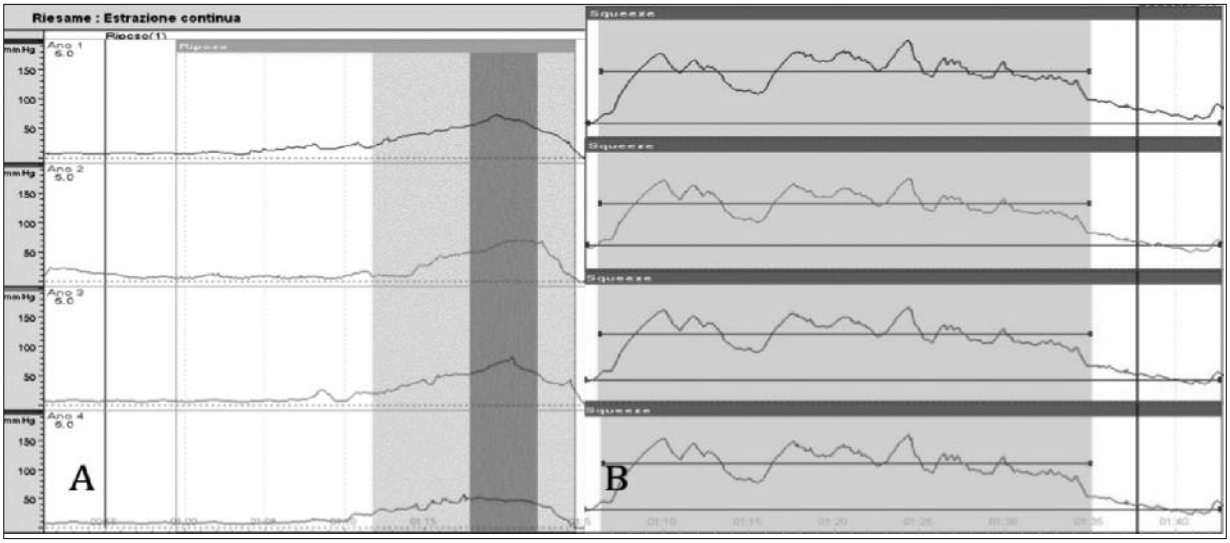


**Figure 1.** Normal resting *(A)* and squeezing *(B)* pressure.

**Table II.** Details of the patients.

| Patients | 1# | 2# | 3# | 4# | 5# |
|---|---|---|---|---|---|
| Sex | M | M | M | M | M |
| Age | 60 | 58 | 45 | 22 | 39 |
| Diagnosis delay | > 48h | > 48h | > 24h – < 36h | < 24h | < 24h |
| IIEF-5 F-up | > 2y | > 2y | > 3y | > 3y | > 2y |
| CICI F-up | > 2y | > 2y | > 3y | > 3y | > 2y |
| ARM F-up | > 1y | > 1y | > 3y | > 1y | < 1y |
| Prolapsed disc level | L4-L5 + LS | L4-L5 | L5-S1 | L5-S1 | L4-L5 |
| Surgical procedure | DL | D L + F | DL | DL | D L + F |

LS = Lumbar Stenosis, DL = Decompressive Laminectomy, F = Fixation.

**Table III.** Results of IIEF-5 and SF-36 in the following controls.

| | 1# | 2# | 3# | 4# | 5# |
|---|---|---|---|---|---|
| IIEF-5 F-up > 1y | 7 | 3 | 8 | 6 | 7 |
| IIEF-5 F-up > 2y | 15 | 7 | 18 | 13 | 24 |
| SF-36 F-up > 1y (ISF/ISM) | 38/37 | 38/50 | 51/22 | 45/47 | 34/42 |
| SF-36 F-up > 2y (ISF/ISM) | 51/49 | 35/29 | 54/46 | 55/45 | 42/60 |

Clinical features and CICI results are shown in Table IV. Two patients reported history of constipation. Four needed significant straining to defecate; 2 suffered for incomplete defecation feeling, and 2 suffered for lack in discriminative rectal ability; 2 patients needed laxatives daily. Three patients referred urinary retention. ARM findings are reported in Table V. In summary, only 2 patients presented increased resting pressure (Figure 2). None patient showed alteration of squeeze pressure, cough reflex or RAIR; 1 patient showed a dyssynergic defecation pattern

**Table IV.** Details of the patients.

| Features | Patients | | | | |
|---|---|---|---|---|---|
| | 1# | 2# | 3# | 4# | 5# |
| Constipation history | – | – | + | + | – |
| Frequency of bowel movements* | D | W2 | W2 | D | D |
| Straining to defecate** | 4 | 0 | 3 | 2 | 4 |
| Anal pain** | 0 | 2 | 0 | 0 | 0 |
| Incomplete evacuation feeling** | 3 | 2 | 0 | 0 | 4 |
| Fragmented defecation** | 0 | 2 | 1 | 0 | 2 |
| Manual manouvres** | 1 | 1 | 0 | 0 | 0 |
| Enemas** | 0 | 4 | 0 | 0 | 0 |
| Laxative use** | 0 | 4 | 4 | 0 | 0 |
| Discriminative rectal ability*** | N | A | N | N | A |
| Fecal incontinence** | 0 | 1 | 0 | 0 | 0 |
| Soiling** | 0 | 2 | 0 | 0 | 0 |
| Urinary retention** | 4 | 4 | 0 | 4 | 0 |
| Abdominal pain** | 0 | 3 | 2 | 0 | 0 |
| Prolonged time to defecate (> 20 min)** | 0 | 4 | 2 | 1 | 1 |
| Chronic Idiopathic Constipation Index (CICI) score 2# | 2 | 14 | 7 | 4 | 2 |

*D: daily; W2: 2/week; W1: 1/week; M1: < 1/week > 1/month; M2: < 1/month. **0: never; 1: < 1/month; 2: > 1/month < 1/week; 3: > 1/week < 1/day; 4: > 1/day. ***N: normal; A: abnormal. #CICI parameters: number of spontaneous defecation, use of laxative, use of enema, abdominal pain, abdominal distension, autonomic neuropathy or associated gastrointestinal motility disturbance, and working ability; each parameter scored from 0 to 3; final score ranging between 0 and 21.

***Table V.*** Results of instrumental colo-rectal evaluation (anorectal manometry).

| Patients | 1# | 2# | 3# | 4# | 5# | Normal value |
|---|---|---|---|---|---|---|
| Maximum resting pressure (mmHg) | 101.5 | 70.7 | 92.5 | 138.2 | 104.4 | 65-100 |
| Mean resting pressure (mmHg) | 43.1 | 36.5 | 40.2 | 72.5 | 68.1 | 35-50 |
| Squeeze pressure (mmHg) | 216.3 | 55.1 | 161.6 | 162.6 | 97.2 | > 30 |
| Defecation pattern | Dyssynergic | Normal | Normal | Normal | Normal | Normal |
| Cough test (presence) | Present | Present | Present | Present | Present | Present |
| RAIR (presence) | Present | Present | Present | Present | Present | Present |
| Threshold for rectal first sensation (ml) | 100 | 50 | 60 | 110 | 90 | 30-60 |
| Threshold for desire to defecation (ml) | 160 | 120 | 120 | 150 | 150 | 70-130 |
| Maximum tolerable volume (ml) | 180 | 170 | 180 | 170 | 210 | 150-230 |

(Figure 3); 3 patients presented abnormality in both rectal threshold for first sensation and desire to defecation; in the other 2 these parameters were within the upper range of normality. The maximum tolerated volume was normal in all patients.

## Discussion

CES is a rare but serious condition, defined as "a spectrum of low back pain, uni or bilateral sciatica, saddle anesthesia and motor weakness in the lower extremities with variable rectal and urinary symptoms"[4]. Its incidence is 1 in 33,000 to 100,000, and it occurs with 2% of all lumbar disk herniations[5]. Bowel and sexual disturbances can be part of clinical presentation at diagnosis but most frequently they become clear later as a consequence of the potentially irreversible neurologic damage of the nerve roots of the cauda equina. Only a modest attention in the literature was focused on bowel and sexual dysfunction compared to urinary impairment. Generally, sphincter activity of the bladder is the only one assessed after injury of the cauda equina with unavoidable less

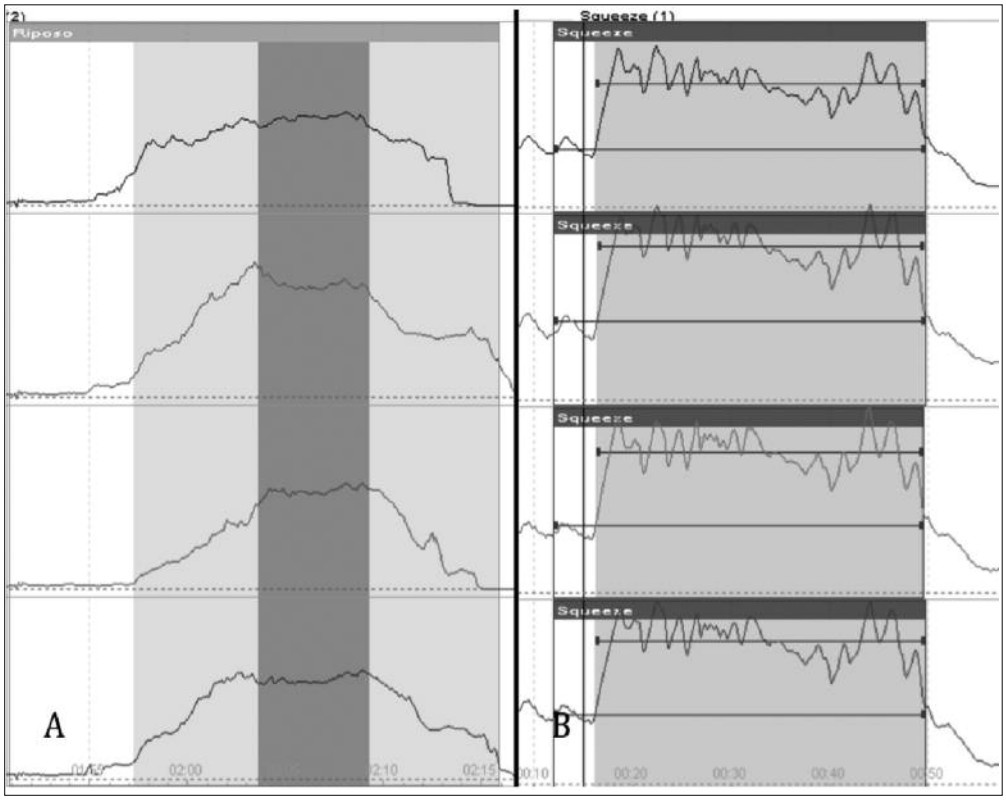


***Figure 2.*** Cauda Equina Syndrome patient resting ***(A)*** and squeezing ***(B)*** pressure.

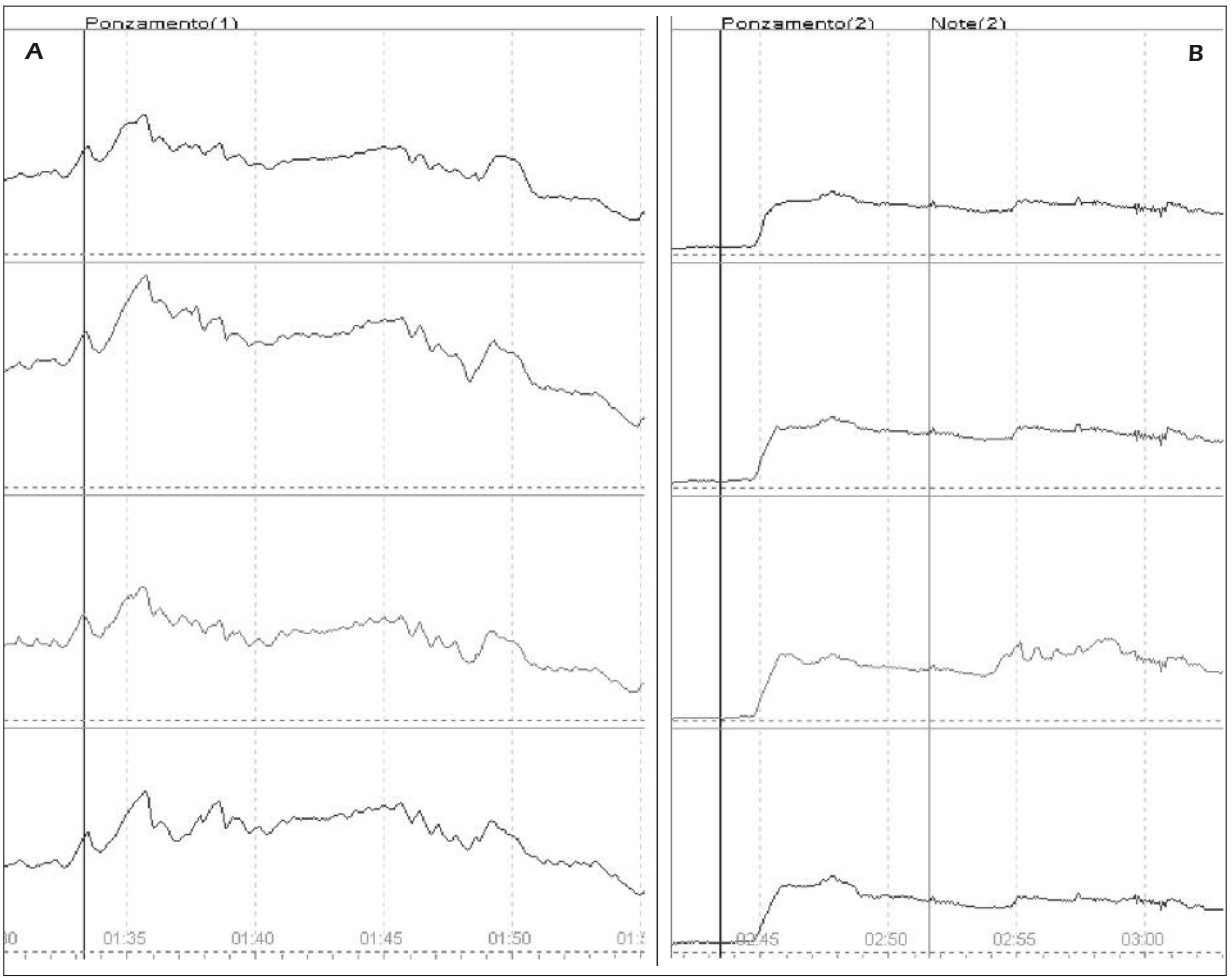


**Figure 3.** Dyssynergic Defecation Pattern: ***(A)*** anal and ***(B)*** rectal abnormal pressures' modification during straining in Cauda Equina Syndrome patient.

accuracy of a thorough evaluation of the functions controlled by the lumbar and sacral nerves. Gitelman et al[5] affirm that, although bowel disorders could be present as an important aspect of the syndrome, the diagnosis of CES is based mainly on urinary dysfunction, as urinary excretion typically occurs more often than bowel's one. Domen et al[6], on the other hand, found rectal incontinence, decreased anal sphincter tone and reflex respectively in 25, 25 and 37.5% of their patients with MRI evidence of cauda compression. They concluded that, in association with urinary retention, rectal incontinence has a predictive value of MRI-confirmed CES. In our experience none of the patients treated reported dysfunctions of bowel and/or sexual function at the time of the admission. The main problem was urinary retention and overflow incontinence associated with an important painful radiculopathy and saddle hypo-paresthesia (Figure 4). Looking at the literature, it does not clearly come out when to perform the surgery. Series in the literature are no homogeneous; many cases were treated in the first 48 hours, while others were managed later. The onset of the syndrome is frequently unclear since some patients showed up with acute sphincter compromising, while others had more subtle symptoms. Further, many cases are not promptly recognized and the diagnosis is made several hours or days later. Shapiro et al[7] stated that patients managed in the first 48h had better results than those treated after, Kostuik et al[8] on the contrary had similar results independently from the timing of surgery. Based on the data of our limited series we cannot say that timing of diagnosis and decompression, although the most important, represented the only prognostic elements able to influence the final outcome. In

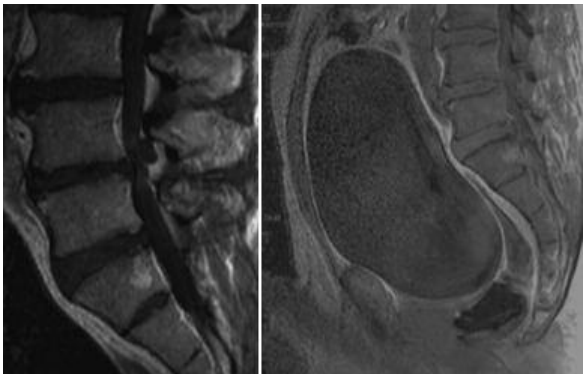

**Figure 4.** Preoperative MRI of the lumbosacral spine of a 45 years old patient with acute onset of cauda equina syndrome due to L4-L5 disc herniated disc disease. A big fragment of intervertebral disc was expelled posteriorly to the dural sac causing compression of the nerves of the cauda equina. A huge bladder for urinary retention is clearly evident, as a incidental feature, on wide MRI sagittal view.

2007, McCarthy et al[4] analyzed the long-term functional and sphincteric outcome in 56 patients with evidence of sphinteric alterations that underwent surgery due to CES. They found that bowel disturbance at presentation was related to both urinary retention and reduced rectal tone as evaluated at rectal examination (but without statistical significance), and sexual dysfunction (with statistical significance) at the follow-up. In detail, postoperative bowel dysfunctions were correlated to acute onset and reduced rectal tone at presentation. Other authors found correlation between bilateral leg pain and permanent bladder and bowel damage[9,10]. In our series, the patient with the worst outcome had a high-grade motor deficit of lower limbs and saddle anesthesia at the hospital admission. At the first follow-up, 1 year after surgical decompression, he presented a high grade of urinary, bowel and sexual dysfunctions. At 2-year f-up the outcome did not improve significantly. Moreover, study of just the bladder function may be misleading given the broad involvement of other functions in the neurologic syndrome. Not a lot is known about long-term follow-up of treated patients but surely neurologic recovery is a very long process. Hellstroem et al[11] reported a very slow but steady recovery of the sphincter function over years, Chang et al[12] on a limited series over a four years f-up, showed that recovery does take place and follow up is crucial to identify the patients who, through the years, will improve the function. Many of the series published, in fact, have short, up to one year, follow up, showing poor outcomes on the more severe and complete syndromes. In our little, homogeneous series we observed that all patients improved significantly over years except the case that showed an high-grade of neurologic impairment since the first appearance of the syndrome. It was also one of the two cases that were managed more than 48 hours after the presumptive onset of the symptoms (3 days later). Sphincter dysfunctions, quality of life and ED improved between the first follow-up (1 year after surgical decompression of lumbar nerve roots) and the following controls minimum two years later. We do not know if these patients recovered partially, but we start to think that a single year of f-up might not be enough as the cauda equina syndrome has very slow recovery times as already reported in literature.

## Conclusions

Although rare, CES is an important cause of rectal and sexual dysfunctions that could be able to lower patients' quality of life and personal wellness; therefore, it should be mandatory to evaluate sexual function, anorectal function, both clinically and manometrically. This is the only way to find the underlying alterations and, consequently, establish the adequate treatment. On the other hand, management of these conditions remains controversial due to the relative limited series in literature and inhomogeneous pattern of clinical presentation. Interesting is the preliminary study on the treatment of fecal incontinence in 11 patients, previously treated for CES, with Sacral Nerve Stimulation (SNS)[13]. Five of them had an improved continence after the permanent implantation of SNS, which is a safe and minimally invasive option well known in the treatment of fecal and urinary dysfunctions[14-15].

A limitation to this study is the low number of patients that does not permit to draw significant statistical conclusion. The choice to consider only cauda equina syndromes due to herniated disc disease and to exclude other causes of lumbar nerve roots compression is the major reason of the low number of patients although, on the other hand, it allows collecting a more homogenous sample to evaluate. Moreover, in this report there is a lack of female patients in the series evaluated. It was not a deliberate choice to exclude women from the study but the only reason was that no female patients were treated in our hospi-

tal during the period took into consideration. Certainly to collect and investigate cases of cauda equina syndrome in female patients could be an interesting aspect for further evaluation because at the moment, given the small number of papers published on the issue, it is very difficult to ascertain the differences in clinical behavior and outcome between sexes.

### Conflict of Interest

The Authors declare that they have no conflict of interests.

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