



Indications for Emergency Surgical Treatment

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2.1 Introduction

Indications for emergency surgical treatment in degenerative spinal conditions are limited to those where a delay in surgical management may lead to potentially catastrophic and irreversible sequelae. Indeed, those conditions are rarely encountered during clinical practice. The most typical scenarios in the thoraco-lumbar region are cauda equina syndrome (CES) and progressive radicular motor deficit (PRMD), both primarily caused by degenerative lumbar pathology. Early surgical treatment may influence the partial or full recovery and the long-term outcome of concerned patients.

CES is a rare condition where the majority of cauda equina nerve roots are suddenly compressed with sudden loss of motor function, of sensation in the saddle area, of sphincter (bladder and/or bowel) and sexual function [1]. PRMD is an analogous pathological condition where patients present with a progressive motor deficit in lower limbs, related to solitary or double nerve root involvement. The typically encountered clinical type of PRMD is *foot drop* due to L5 and/or L4 nerve root compression. The severity of motor

deficit of PRMD is graded by means of the manual muscle testing (MMT) according to the Medical Research Council Scale (Table 2.1) [2].

In most of the cases, both CES and PRMD are caused by an acute disc prolapse compressing the nerve roots, especially if the onset of symptoms is sudden. Nevertheless, other degenerative disorders such as synovial cysts, lumbar stenosis, spondylolisthesis and other compressive pathology (e.g. infections, tumors) can cause the neurological deficit. MRI should be the radiologic imaging of choice since it can not only confirm compression of spinal nerve structures, but also define the underlying pathology. Additional radiographs, with dynamic flexion and extension images and CT might be added if the spinal morphology as encountered on MRI demands for this.

The aim of this chapter is to illustrate via two cases the surgical management of CES and PMRD patients, outlining indication and timing for surgery as well as discussing the evidences in the literature.

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Table 2.1 Manual Muscle Testing (MMT) according to the Medical Research Council scale of muscle strength [2]

0	No contraction
1	Flicker or trace of contraction
2	Active movement, with gravity eliminated
3	Active movement against gravity
4	Active movement against gravity and resistance
5	Normal power

2.2 Case Description

2.2.1 Case 1

A 39 years old male was admitted to a tertiary hospital complaining of right sciatic pain without neurological deficit for 10 days. A medical therapy with pain killers (NSAID drugs) was prescribed and the patient discharged. Five days later, he was admitted in our emergency department complaining of acute onset of bilateral foot distal weakness, associated with perineal loss of sensation, urinary retention and constipation.

The neurological exam showed a L4 paraplegia with bilateral L5-S1 weakness (MMT 1/5), sacral (S1-S5) hypoesthesia, and urinary retention. The patient was catheterized and sent to MRI. The MRI showed a L3-L4 disc prolapse in the context of a congenital and acquired multiple level lumbar stenosis. The herniation compressed the cauda equina and the canal sagittal diameter was dramatically reduced (Fig. 2.1).

The patient was immediately brought to OR for emergency surgical decompression. Surgery consisted of posterior midline approach with L3-L4 flavectomy, L4 right laminectomy and contralateral undercutting, sequestrectomy and microdiscectomy. Surgery was uneventful and the patient admitted to the recovery room.

Then, the patient was sent to a specialized center for rehabilitation. He underwent physical therapy, ergo-therapy, vector physical therapy, swimming, and he received psychological support. Sphincter deficits were treated with anticholinergic drugs, self-catheterization, and manual rectal clear. The patient was discharged after 2 months and ambulatory physical therapy was prescribed to him.

A one-year postoperative MRI (Fig. 2.2) showed no more disc herniation and a persistent congenital and acquired lumbar stenosis. The patient was able to walk 1 km with crutches. He was still performing self-catheterizations and manual rectal clear 2 times/day. Persistent neurogenic perineal pain was treated by pregabalin.

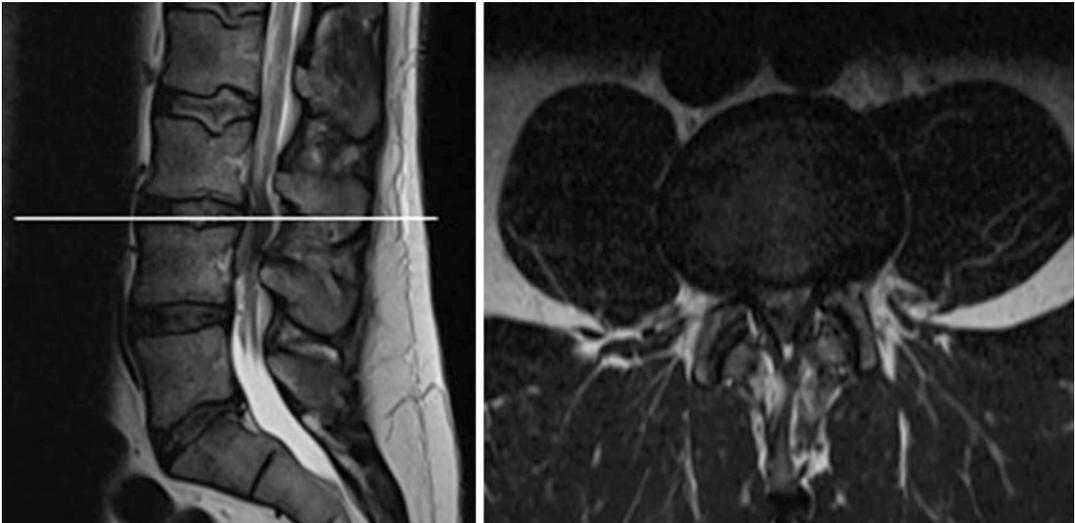


Fig. 2.1 Sagittal (left) and axial (right) MRI showing a large, median and downward migrated disc fragment at L3-L4 level, with cauda equina compression

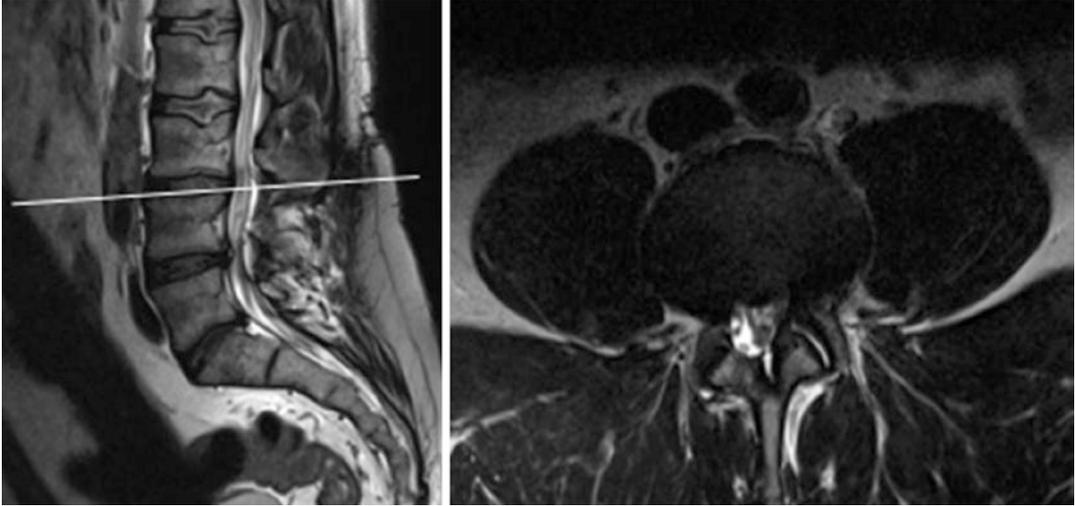


Fig. 2.2 Sagittal (left) and axial (right) 1 year post-operative MRI showing absence of recurrent disc herniation and a complete nerve roots' decompression

2.2.2 Case 2

A 62 years old male patient consulted with left irradiating leg pain into the foot and associated inability to dorsiflex the left ankle. Onset had been 3 months prior to presentation, without injury or brisk movement. No bladder or bowel problems were reported.

Clinical examination revealed a motor deficit MMT 3/5 of both extensor hallucis longus and tibialis anterior muscles. The patient showed the characteristic foot drop steppage gait. Straight leg test was negative. Mechanical back pain testing was low.

The clinical pattern was in line with the radiologic finding of compression of the left L4 and L5 nerve roots, caused by a synovial cyst of the left L4/5 zygoapophyseal joint and by spondylosis and grade I degenerative spondylolisthesis with consecutive stenosis of the L5 recess (Fig. 2.3).

Because no major instability criteria were evident, microsurgical decompressive surgery was advocated and carried out 10 days later. A left L5 hemilaminectomy, cyst removal, and L4 and L5 nerve root decompression were carried out without complications.

Following surgery, the patient was relieved from leg pain. However, he did not observe improvement of muscle strength. Postoperative MRI was carried out but did not show residual nerve root compression (Fig. 2.4). An ankle-foot orthosis was prescribed, but the patient did not see any functional benefit from it.

The surgical result (relief from leg pain, foot drop persistence, MMT 3/5) remained unchanged at follow-up at 3 months, 1 year and 2 years following surgery. Repeated electromyography and nerve conduction studies confirmed an L5 nerve root damage that appeared permanent.

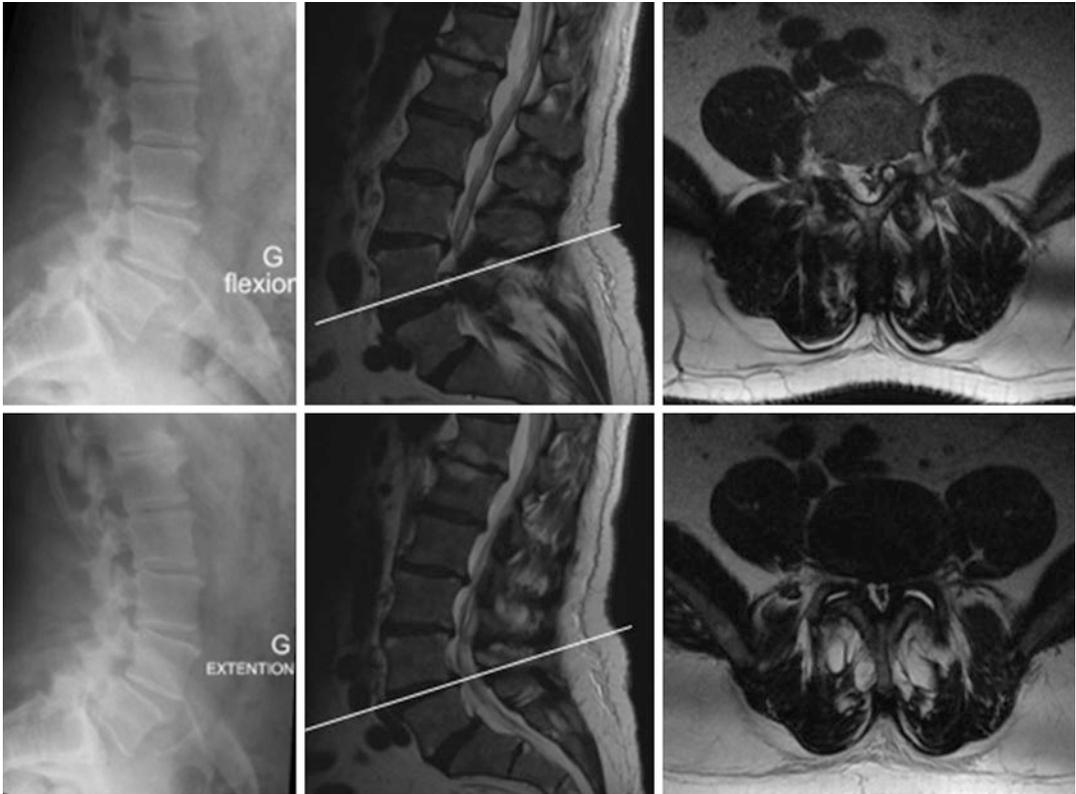


Fig. 2.3 Preoperative dynamic radiographs in flexion and extension, showing minor spondylolisthesis between L4/L5 and L5/S1, without dynamic component. T2-weighted MRI in sagittal and axial planes showing radiologic com-

pression of the left L4 nerve root by synovial cyst formation, left L5 nerve root compression by spondylosis and spondylolisthesis with consecutive recess stenosis

2.3 Discussion of the Cases

2.3.1 Case 1

This case illustrates a typical clinical scenario of CES related to a disc prolapse.

In this particular case, symptoms started in form of severe sciatic pain few days before the installation of CES. The surgical decompression was immediately performed. Time to decompression is the best described outcome predictor in CES. Ahn *et al.* performed a meta-analysis to determine the correlation between timing of decompression and clinical outcome in 322 patients [3]. Significant differences were found in resolution of sensory and motor deficits as well as urinary and rectal function in patients treated

within 48 h compared with those treated more than 48 h after onset of symptoms.

In that specific case, despite the fact that the treatment was performed according to the literature guidelines, the patient kept some sequelae of CES at 1 year time follow-up. This demonstrate how this condition may be disabling even though correctly managed.

Contrary to the well-known and studied prevalence and outcome of motor and sensitive sequelae, few data are available on the long-term outcome of micturition, defecation and sexual function after spinal surgery for CES. A study from a Dutch group clearly demonstrated that dysfunction of micturition, defecation and sexual functions are still highly prevalent in a large number of CES patients even years postoperatively [4].

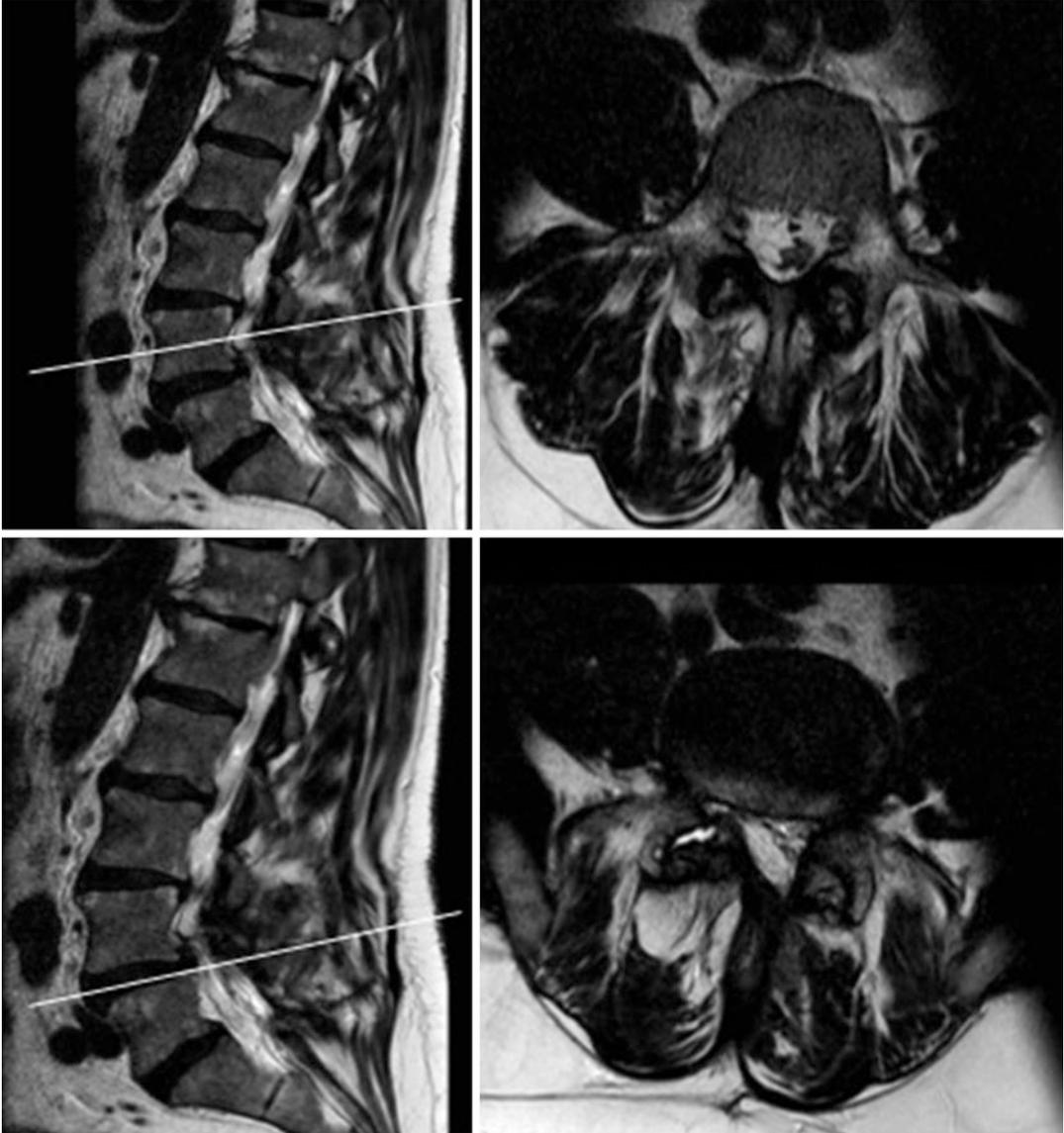


Fig. 2.4 Postoperative T2-weighted MRI in sagittal and axial planes showing effective decompression of both nerve roots by resection of the synovial cyst and recessotomy

2.3.2 Case 2

This chapter covers the emergency situation of severe motor deficit attributable to degenerative spinal disorders at the example of the descriptive symptom *foot drop*. The first step in the management of this scenario is to rule out alternative causes of foot drop (peroneal nerve palsy, brain lesions, spinal cord lesions, MS, polyneuropathy, etc.). A thorough clinical examination and radio-

logic workup will allow to determine if lumbar degenerative disorder can be responsible or not.

Assessment of motor deficit follows the manual muscle testing (MMT) according to the Medical Research Council Scale (Table 2.1) [2]. It should be mentioned that several studies define foot drop as MMT of less than 3 (i.e. 2, 1 or 0), and “good” recovery if a postoperative MMT of 3 is achieved. In contrast, our case presentation shows well that MMT 3 effectively remains a

Table 2.2 Probability estimates of postoperative motor recovery to strength ≥ 3 or ≥ 4 MMT according to Takenaka et al. [8]

Frequency (n _{total} = 102)	Predictors		Outcome	
	Pre tibialis anterior muscle strength	Duration (days)	Post tibialis anterior muscle strength ≥ 3	Post tibialis anterior muscle strength ≥ 4
31.4% (n = 32)	2 or 3–	≤ 30	96.9%(n = 31/32)	87.5% (n = 28/32)
33.3% (n = 34)	2 or 3–	> 30	61.7% (n = 21/34)	41.2% (n = 14/34)
14.7% (n = 15)	0 or 1	≤ 30	53.3% (n = 8/15)	46.7% (n = 7/15)
20.6% (n = 21)	0 or 1	> 30	14.3% (n = 3/21)	9.5% (n = 2/21)

foot drop, hence, it should not be considered a good recovery result.

Strong evidence of the superiority of decompressive surgery over conservative treatment for PRMD in the literature is sparse. One explanation for this is the difficulty to perform a randomized controlled trial on this issue – MMT3 or less or progressive deficit are considered absolute indications for surgery, [5] since deficits of this importance as potential final outcome render conservative strategies inappropriate for clinicians and patients. Foot drop is a severe handicap for daily live and the general paradigm to perform surgical decompression of neural structures to reduce ongoing compressive secondary damage has every reason to be applied here as long as no opposed evidence is published.

Overdevest *et al.* have published a sub-analysis of 150 patients with sciatic pain and PRMD [6]. The data was taken from a formed subgroup of the prospective randomized controlled Sciatica Trial of Peul *et al.* – a study designed to analyze surgery versus prolonged conservative treatment for radicular pain, independent from PRMD [7]. The authors of the former found a significantly faster recovery of motor deficit following surgery, but no remaining difference between motor function recovery of the surgical and the conservative arms of the sub-group 1 year after randomization. The original study of Peul *et al.* had excluded patients with MMT less than 3 for the reason mentioned above, hence the collec-

tive of Overdevest *et al.* contained only patients with MMT 3 or 4, of which patients with MMT 4 showed better recovery. Even if the study did not show time to surgery as a factor for motor recovery, it must be mentioned that this interval was fairly long, 11 weeks in average due to the design of the original work, and it can be argued that faster surgery might have further improved the surgical results. This is strengthened by retrospective studies that focus on preoperative MMT and time to surgery as factors influencing recovery [8, 9]. Elder patient age and etiology other than soft disc hernia are also considered negative predictive factors [8]. On the basis of the analysis of their retrospective work on 102 patients with foot drop due to lumbar degenerative disorder, Takenaka *et al.* have published a decision support tool that indicates, with reference to the respective preoperative MMT and time to surgery, the potential of recovery following surgery (Table 2.2) [8].

The advantage of surgery might become more difficult to advocate when no nerve root pain is present upon presentation, since the absence of leg pain takes out the best reproducible effect of surgery, leg pain reduction. Significant improvement after surgery in painless cases was nonetheless observed in 65% of patients in one retrospective work dedicated to painless foot drop of 20 patients [10].

The available data point on the effect of surgery and furthermore on the importance of time to surgery. Hence, it is a logic approach to con-

sider that the earlier the presentation to the surgeon, the higher the benefit from early or urgent surgery. That is, a patient with MMT 3 since 6 h is more urgent than a patient with MMT 2 since 3 months. In our institution, patients with acute onset of MMT 3 or less or progressive deficit are operated the same day.

2.4 Conclusions and Take-Home Messages

Early surgical decompression for CES or PRMD such as foot drop, if attributable to spinal disorder, remains the standard of care at date. Urgent surgery in less than 48 h should be advocated unless in exceptional cases. Even partial functional recovery will make a difference for every day life for these patients. Persistent sexual and urinary dysfunction should not be trivialized and will require close follow-up and neurorehabilitation counseling.

Pearls

- Sudden limb weakness or bladder or bowel dysfunction requires immediate clinical and radiological work-up
- Profound knowledge of nerve root patterns and a thorough clinical examination indicate the affected compressed nerve root or nerve roots
- PRMD and CES result in severe handicaps. Perform decompression surgery as early as possible to maximize recovery chances for your patient

Editorial Comment

It is the editors' strong belief, that a CES is always an immediate emergency situation and that there is no given time limit for surgery. A motor weakness grade 4 may be treated with prolonged conservative care, while a greater weakness should prompt urgent (<24h) surgery.

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