ORIGINAL ARTICLE

Impact of timing on surgical outcome in patients with cauda equina syndrome caused by lumbar disc herniation

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ABSTRACT

Aim To analyze the relationship between timing of surgery and outcome in patients with cauda equina syndrome caused by lumbar disc herniation.

Methods A retrospective, non-randomized clinical study included 25 consecutive patients with cauda equina syndrome (CES) caused by lumbar disc herniation. All patients were operated within 24 hours after hospitalization at the Department of Neurosurgery, Cantonal Hospital Zenica, Bosnia and Herzegovina, between January 2000 and December 2010. All patients were evaluated before surgery on the basis of complete history, neurological examination and neuroimaging evaluations using CT (computed tomography) and MRI (magnetic resonance imaging).

Results Statistically significant difference between preoperative and postoperative bladder (p=0.05) and bowel (p=0.05) function was found. A significant number of patients had bladder and bowel recovery after surgery, nine (36%) and 11 (44%), respectively. Significant recovery of muscle strength was noted with complete recovery (5/5) in 12 (48%) and partial recovery in 13 (52%) patients. Complete sensory recovery was noted in 16 (64%), incomplete in four (16%), and in five (20%) patients there were no changes. Most commonly, patients with complete sensory recovery were operated within 48 hours of symptom onset. In most patients early surgery was associated with better outcome.

Conclusion This research showed that early decompression correlated with better outcome. Patients with cauda equina syndrome must be cleared for surgery in optimal conditions and, if it possible within optimal timing for recovery (within 48 hours).

Key words: sphincter dysfunction, early decompression, recovery

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INTRODUCTION

Cauda equina syndrome (CES) is a rare, but devastating neurological condition. The incidence of CES secondary to lumbar disc herniation is 2–6% (1). In 1929 Dandy first described CES caused by lumbar disc herniation (2). Etiologies of CES include lumbar disc herniation, trauma, hematomas, spinal anesthesia, metastatic invasion or other tumors, inflammatory neuropathy, etc. (3, 4). CES is a clinical diagnosis based on patient history and neurological examination. The radiological studies, especially magnetic resonance imaging (MRI), are used to confirm the diagnosis, nature and location of a lesion (5). The signs and symptoms of CES include low back pain, unilateral or bilateral sciatica, motor weakness of the lower extremities, sensory disturbances, and loss of bowel or bladder function (6). CES is an indication for emergent surgical decompression (2). Reportedly, early decompression, within 48 hours, is associated with a better outcome (7).

The aim of this study was to analyze the relationship between timing of surgical intervention and outcome in patients with CES caused by lumbar disc herniation.

PATIENTS AND METHODS

Patients and study design

A retrospective, non-randomized clinical study included 25 consecutive patients with complete cauda equina syndrome (CES) caused by lumbar disc herniation. All patients were operated at the Department of Neurosurgery, Cantonal Hospital Zenica, Bosnia and Herzegovina, between January 2000 and December 2010. In this period 979 patients with herniated lumbar disc were operated. CES was detected in 25 patients. Patients with CES caused by the tumor, vertebral fracture, spinal anesthesia, lumbar canal stenosis without significant lumbar disc herniation and patients with spondylolisthesis were excluded from the study.

All patients were operated within 24 hours after hospitalization, 22 (88%) of whom were males and three (12%) were females; patient age was ranging from 29 to 68 years (median 49).

All patients were evaluated before surgery on the basis of complete history, neurological examination and neuroimaging evaluations including computed tomography (CT) and MRI.

Neurological and clinical examination

All patients included in this study had low back pain and radicular pain before the appearance of neurological dysfunction, complete urinary retention, reduction of muscle strength and symmetric or asymmetric sensory disturbances specific to CES. Of those 25 patients, 22 (88%) had a complete and 3 (12%) patients had partial bowel dysfunction. Preoperative and postoperative muscle strength (six months after operation) was evaluated using the Medical Research Council (MRC) scale (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) (8).

All patients had complete urinary retention. Postoperative urinary function outcome (six months after the operation) was defined as normal (with complete recovery of bladder function), partial retention (with incomplete recovery of bladder function requiring catheterization), and poor (complete retention) (for permanent urinary retention and requiring catheterization). Of 25 patients, 22 (88%) had complete and three (12%) patients had partial bowel dysfunction (retention or incontinence).

Postoperative bowel function recovery was defined as complete, partial and incomplete. All patients had symmetric or asymmetric sensory disturbances specific to CES. Preoperative and postoperative evaluation of sensation was based on 3-point ordinal scale (0 – absent, 1 – impaired, 2 – normal) (9).

We did not evaluate sexual function because the study is retrospective and in most cases the data were missing in the patients' history record.

Of 25 patients with CES 10 (40%) had CES caused by herniated lumbar disc with consecutive spinal canal stenosis, and in 15 (60%) patients CSE was caused by the lumbar disc extrusion. The first group of patients was surgically treated by microdiscectomy, and the second group by sequestrectomy or sequestrectomy and microdiscectomy. No complications were noticed in any group.

Follow up

All patients underwent postoperative physical treatment and had a follow up. According to the protocol of the Department of Neurosurgery of the

Cantonal Hospital Zenica all patients had the latest control examination six months after surgery.

Statistical analysis

The methods of descriptive and comparative statistics were used ($\chi 2$ and p-test) and the results are presented in tables and expressed by relative values and mean value. Statistically significant difference was set to $p<0.05$.

RESULTS

Patients' characteristics

Of the total number of 979 patients with herniated lumbar disc 25 (2.55%) patients with cauda equina syndrome were surgically treated at the Department of Neurosurgery of the Cantonal Hospital Zenica during the period 2000-2010.

Of those 25 patients, 22 (88%) were males and three (12%) were females with the age ranging from 29 to 68 years (median 49).

Clinical characteristics

Low back pain, bilateral or unilateral sciatica were initial manifestations in all patients before the cauda equina syndrome formation.

Duration of radicular and low back pain before the cauda equine symptoms was less than 30 days in most patients, 18 (72%); four (12%) patients had symptoms for more than six months, and in one (4%) and two (8%) patients the duration of these symptoms before CES was six months to one year and more than one year, respectively.

Duration time from the occurrence of cauda equina symptoms, completion of diagnostic evaluation and surgical procedure was less than two days in nine (36%), two to five days in six (24%), five to 10 days in five (20%), 10 to 30 days in three (12%), and more than 30 days in only two (8%) patients.

Table 1. Preoperative,and six months after surgery bladder and bowel function

	No (%) of patients			
	Preoperative		Six months after surgery	
Function	Bladder	Bowel	Bladder	Bowel
Retention	25 (100)	23 (92)	7 (28)	7 (28)
Partial retention	0 (0)	2 (8)	9 (36)	7 (28)
Normal	0 (0)	0 (0)	9 (36)	11 (44)
Total	25 (100)	25 (100)	25 (100)	25 (100)

Before the surgery all patients had complete urinary retention, reduction of motor power and symmetric or asymmetric sensory disturbances specific to CES. Of 25 patients, 22 (88%) had complete, and three (12%) patients had partial bowel dysfunction. Six months after the surgery postoperative recovery of the bladder and bowel function was noticed in nine (36%) and 11 (44%) patients, respectively (Table 1).

The comparison of the preoperative and postoperative bladder function in relation to timing of surgery showed complete recovery of urinary function in eight (89%) out of nine patients who were operated within 48 hours of onset of neurological dysfunction (nine of 25 patients) (Table 2). Only one (11%) patient had partial urinary retention. Of six (out of 25, 24%) patients who were operated in the period within 2-5 days of onset of neurological dysfunction, complete recovery of urinary function was detected in one (16.7%), partial recovery in four (66.7%), and complete retention in one (16.7%) patient after 6-month follow up. In 10 (out of 25, 40%) patients who were surgically treated after 5 days of onset of neurological dysfunction six (60%) patients had complete urinary retention (Table 2).

Bowel function recovery was similar to bladder function recovery in patients surgically treated within 48 hours of neurological dysfunction onset. In patients who were operated after 48 hours the bowel function recovery was worse than bladder one (Table 2).

Table 2. Preoperative and postoperative sphincter function in relation to time duration between symptoms onset and surgery

Time duration between symptoms onset and surgery	No (%) of patients											
	Preoperative						Six months after surgery					
	Bladder			Bowel			Bladder			Bowel		
	R	PR	N	R	PR	N	R	PR	N	R	PR	N
Less than 2 days	9 (36)	0	0	8 (32)	1 (4)	0	0	1 (4)	8 (32)	0	1 (4)	8 (32)
2 to 5 days	6 (24)	0	0	5 (20)	1 (4)	0	1 (4)	4 (16)	1 (4)	1 (4)	3 (12)	2 (8)
5 to 10 days	5 (20	0	0	5 (20)	0	0	2 (8)	3 (12)	0	1 (4)	3 (12)	1 (4)
10 to 30 days	3 (12)	0	0	3 (12)	0	0	2 (8)	1 (4)	0	3 (12)	0	0
More than 30 days	2 (8)	0	0	2 (8)	0	0	2 (8)	0	0	2 (8)	0	0
Total	25 (100)	0	0	23 (92%)	2 (8%)	0	7 (28%)	9 (36%)	9 (36%)	7 (28%)	7 (28%)	11(44%)

R, retention; PR, partial retention; N, normal

Statistically significant difference between preoperative and postoperative bladder (p=0.05) and bowel function (p=0.05) was found, e. g., a significant number of patients had bladder and bowel recovery after surgery (Table 2).

Muscle strength function was evaluated using MRC scale. Complete recovery (5/5) was noted in 12 (48%) patients, and partial recovery was noted in 13 (52%) patients (4/5, 3/5 and 0/5 in four (16%), 8 (32%) and one patient, respectively (4%) (Figure 1).

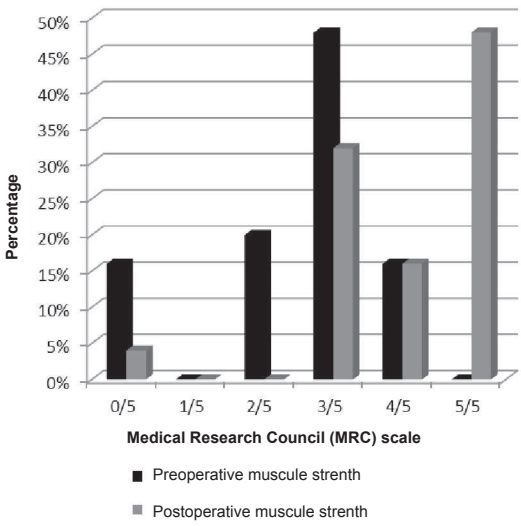

Figure 1. Preoperative and postoperative muscle strength according to Medical Research Council (MRC) scale

Complete sensory recovery was noted in 16 (64%) patients, incomplete in 4 (16%) and no changes were found in 5 (20%) of all patients. Most patients with complete sensory recovery were operated within 48 hours of onset of symptoms. Complete sensory recovery occurred in 11 (44%) patients, who were operated within 48 hours of onset of symptoms, and 5 (20%) patients, who were operated after 48 hours of onset of symptoms and had partial sensory recovery. Persistent sensory deficit was noticed in 9 (36%) patients (data are not shown).

In most patients early surgery was associated with a better outcome (Table 1, 2).

Surgery and complications

All patients were urgently evaluated (neurological examination, laboratory, CT or/and MRI) and they underwent surgery within 24 hours of hospitalization. The patients were treated by microneurosurgical technique (sequestrectomy, microdiscectomy or both). Modality of surgery treatment included sequestrectomy and microdiscectomy in 13 (52%) patients. Only in two (8%) patients sequestrectomy was enough, and in 10 (40%) patients it was fulfilled with microdiscectomy.

In 15 (80%) patients CT or MRI showed massive lumbar disc extrusion; in 10 (40%) patients significant lumbar disc herniation with consecutive spinal canal stenosis was found.

In most cases surgery was performed on the level L4/L5 (Figure 2).

There were no complications noticed.

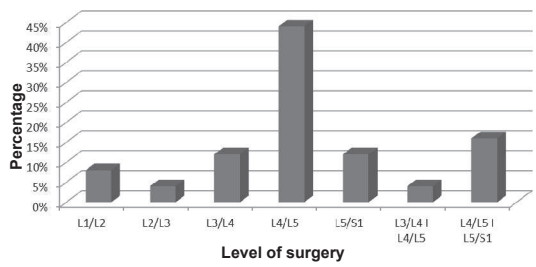

Figure 2. Level of microneurosurgery (sequestrectomy, microdiscectomy or both) in patients with cauda equine syndrome

DISCUSSION

Cauda equina syndrome (CES) is a rare, but devastating clinical condition that has been described as a complex of symptoms and signs such as low back pain, unilateral or bilateral sciatica, motor weakness of lower extremities, sensory disturbance in the saddle area, urinary retention or overflow incontinence, constipation or fecal incontinence (2,5). CES can be caused by many conditions such as lumbar disc herniation, lumbar spinal canal stenosis, trauma, hematoma, tumors, infection etc. (10,11). Lumbar disc herniation is the most common cause of CES. CES occurs in approximately 2-6% of cases of herniated lumbar disc and it is one of the few spinal surgical emergencies (1,5,12,13). In our study the prevalence of CES among 979 patients surgically treated at our department in the ten year period was 2.55 %. Those data correspond to the literature (14).

In the literature, CES caused by lumbar disc herniation is most common in middle-aged male patients (15-17), which corresponds with our results. In this study patients mostly had previous low back pain and sciatica, which is in concordance with the literature (2-5, 18, 19).

There is controversy about timing of surgical decompression in CES and its influence on outcome. Some studies suggested that early decompression within 48 hours is associated with better outcome (3, 11, 12, 16, 20). A significant improvement in sensory and motor deficits as well as urinary and rectal function occurred in patients who underwent decompression within 48 hours versus after 48 hours (14, 15, 21-23). Some studies suggested that there was no statistically significant difference in outcome between patients who were operated within 48 hours and patients who were operated after 48 hours (5, 24, 25).

Most researchers and clinicians now believe that a good outcome can be achieved in patients who undergo surgery within 48 hours of onset of neurological dysfunction, while significantly poorer outcomes are associated with surgical intervention after 48 hours (3, 12, 16, 20, 25-28).

The results of our study show that early decompression was associated with better outcome.

In practice, CES is a condition that requires immediate surgery. It should not be forgotten that delayed treatment could lead to significant morbidity and potential persistent neurological dysfunction (1,3,16). On the other hand, emergent decompression could expose the patient to additional risk (16). For that reason we did not perform CES surgery late at night or midnight in suboptimal conditions. Such patients were scheduled for surgery for next day when more qualified staff and optimal conditions were available.

Following surgery, the extent of recovery is variable. Some patients have pain, problems with the bladder or bowel. Recovery of these functions depends on the duration and severity of symptoms prior to surgery (1-5, 16).

CES most commonly occurs in intervertebral disc herniation at the L4/L5 level (5, 12, 16). The results of our research correspond with the literature.

In conclusion, although the controversies exist about the timing of surgery in patients with CES, our research showed that early decompression correlated with better outcome. Delayed surgery could lead to potentially persistent neurological dysfunction, but emergent surgery in suboptimal conditions (late night or midnight) could expose patients to additional risk. For this reason, the patients with cauda equina syndrome may be cleared for surgery in optimal conditions and, if possible within optimal timing for recovery (within 48 hours).

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TRANSPARENCY DECLARATIONS

Competing interest; none to declare.

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Utjecaj vremena do operacije na ishod kodpacijenata sa sindromom kaudeekvine uzrokovane lumbalnom diskushernijom

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SAŽETAK

Cilj Ispitati povezanost između vremena proteklog do operacije i ishodak od pacijenata sa sindromom kaudeekvine.

Metode Retrospektivna, nerandomizirana klinička studija uključila je 25 pacijenata sa sindromom kaudeekvine (CES)uzrokovane lumbalnom diskushernijom. Svi pacijenti uključeni u studiju operirani su unutar 24 sata od hospitalizacije u Službi za neurohirurgiju Kantonalne bolnice Zenica, u periodu od januara 2000. do decembra 2010. godine. Svi pacijenti su preoperativno dijagnostički obrađeni, što je uključivalo historiju bolesti, neurološki pregled, neuroradiološku obradu korištenjem CT-a (kompjuterizirana tomografija) i MRI-a (magnetna rezonanca).

Rezultati Ustanovljena je statistički značajna razlika između preoperativnog i postoperativnog nalaza funkcije pražnjenja mokraćnog mjehura (p=0,05) i pražnjenja crijeva (p=0,05).Značajan broj pacijenata imao je potpun oporavak funkcije pražnjenja mokraćnog mjehura i crijeva nakon operacije, 9 (36%), odnosno 11 (44%). U većini slučajeva je registriran značajan oporavak grube mišićne snage, potpun oporavak kod 12 (48%), a djelomičan kod 13 (52%) pacijenata.Kompletan oporavak senzibiliteta zabilježen je kod 16 (64%) pacijenata, parcijalan kod 4 (16%), dok kod 5 (20%) pacijenata nije bilo promjena u odnosu na period prije operacije. Većina pacijenata s kompletnim oporavkom grube mišićne snage i senzibiliteta operirana je unutar 48 sati od pojave neurološkog deficita.Kod većine pacijenata rani operativni zahvat je rezultirao boljim ishodom.

Zaključak Istraživanje je pokazalo da rana dekompresija rezultira boljim ishodom kod pacijenata sa sindromom kaude ekvine. Pacijenti sa sindromom kaude ekvine trebaju biti planirani za operativni zahvat u optimalnim uvjetima i, ukoliko je moguće, u optimalnom periodu (unutar 48 sati).

Ključne riječi: sfinkterijalna disfunkcija, rana dekompresija, oporavak