Archives of Community and Family Medicine

ISSN: 2638-4787

Volume 3, Issue 2, 2020, PP: 58-66

A Brief Rating Scale of Subjective Persistent Symptoms of the Cauda Equina Syndrome for Family Physicians or Medical Psychologists

Zack Z. Cernovsky[1]*, Alejandro Mateos-Moreno[2], L. Kola Oyewumi[3], Varadaraj Velamoor[4], Stephan Mann[5], James D. Mendonça[1], Viridiana Sánchez-Zavaleta[2], Maria Elena Hernández-Aguilar[2], Michel A. Woodbury-Fariña[6], Mariwan Husni[7], Yves Bureau[8]

[1*]Department of Psychiatry, Western University, London, Ontario, Canada.

[2]Centro de Investigaciones Cerebrales, Universidad Veracruzana, Xalapa, Veracruz, México.

[3]Professor Emeritus, Departments of Psychiatry, Biomedical and Molecular Sciences, and Psychology, Queen's University, Canada.

[4]Professor of Psychiatry, Laurentian and Lakehead Universities, and Professor Emeritus of Psychiatry, Western University, Canada.

[5]Central Montgomery Behavioral Heath, Norristown, PA, USA.

[6]Department of Psychiatry, University of Puerto Rico, USA.

[7]Departments of Psychiatry, Arabian Gulf University, Bahrain, and Northern Ontario School of Medicine, Thunder Bay, Ontario, Canada.

[8]Departments of Psychology and Medical Biophysics, Western University, Ontario, Canada.

***Corresponding Author:** Zack Z. Cernovsky, Department of Psychiatry, Western University, London, Ontario, Canada.*

Abstract

***Background:** Case studies have shown that some persons develop an acute cauda equina syndrome from injuries to perispinal tissues and/or vertebral fractures in motor vehicle accidents (MVAs). It is of neuropsychological interest to examine if persistent subjective symptoms of injury to the area of cauda equina are present, in milder forms, even in post-MVA patients who have not sustained documented vertebral fractures, when such patients are interviewed many months after their accident. This study presents statistical data on a 5 item screening scale to measure such subjective persistent symptoms of cauda equina syndrome. This scale may be used by family physicians or by specialized medical psychologists to determine if a referral to a neurologist is warranted and necessary.*

***Method:** Archival de-identified data on 67 Canadian patients in the Toronto area (mean age 38.8, SD=11.7; 25 men and 42 women) who survived serious MVAs were evaluated for the presence of the following 5 symptoms: (1) pathological tingling extending over the gluteus, between the legs or on upper thighs, and over lower abdomen, (2) numbness extending over the gluteus, between the legs or on upper thighs, and over lower abdomen, (3) reduced control over leg muscles, (4) impaired control over the urinary bladder, and (5) impaired bowel control.*

***Results:** Frequencies of reports of moderate or severe symptoms involving these 5 items were as follows: reduced control over legs by 25.4% of patients, impaired bladder control by 18.0% of patients, tingling in lower body or legs by 16.5% of patients, impaired bowel control by 14.9% of patients, and numbness in lower body or legs by 9.0% of the patients. This 5 item scale has a satisfactory internal consistency (Cronbach's alpha = .77) and item-total correlations. This screening scale for cauda equina syndrome has satisfactory convergent validity as shown by its significant correlations, in our sample of patients, to other subjectively reported whiplash symptoms (r=.69) and also by significant positive correlations to various ratings of pain (rs of .33 to.42), insomnia (r=.43), post-concussive symptoms as operationalized by Rivermead scores (r=.40), PTSD as measured via PCL-5 (r=.49), and depression (r=.33).*

Discussion and Conclusions: *This cauda equina syndrome scale is meant to serve only as a brief screening tool for physicians or psychologists to assess subjective reports of persistent mild to moderate symptoms of cauda equina syndrome, in order to determine whether referral to a neurologist for expert assessment (e.g., MRI) and treatment would be helpful. Correlational studies of the relationship of scores on this screening scale with MRI findings and neurological diagnosis are needed. Such studies would help to establish a cutoff threshold score for referrals to neurology.*

Keywords: *cauda equina syndrome, neuropsychology, whiplash syndrome, lumbo-sacral spine*

Introduction

The numerous nerves that branch out from the lower end of spinal cord are known as the cauda equina, due to their anatomical resemblance to a horse's tail. This portion of the spinal region contains nerves that innervate sensory and motor targets within the lumbar, sacrum, and coccygeal levels (Ridley, et al. 2018). The role of these nerves projecting distally into the lumbar cavity from the L2-L5 segments of the spinal cord to the coccyx is to provide somatic efferent innervation to the muscles of the lower limb and somatic afferent sensations such as vibration, proprioception, pain, and temperature (Kunam, et al., 2018). The parasympathetic nerves provide visceral efferent signals to the urinary bladder from the spinal cord at levels S2 to S4, controlling the urination process, while the sympathetic fibers that go from T11 to L2, regulate the filling of the urinary bladder (Quaile, et al., 2019). Thus, the nerves within the cauda equina provide motor and sensory connections between the brain and the legs, the pelvis, and the urinary bladder.

Subjectively experienced persistent symptoms of the cauda equina syndrome may be as follows: numbness over the gluteus area, between the upper legs, and over the lower abdomen (so called "saddle anesthesia"), unpleasant tingling in these same areas, recent onset of urinary incontinence or urinary retention, or of bowel incontinence, sensory abnormalities in the bladder or rectum, sexual dysfunction, severe pain in the lower back, and symptoms in lower limbs or pelvis such as muscular weakness, numbness, pain, or loss of normal reflexes (Spector et al, 2008, Gitelman et al 2008, Orendacova 2001, Cernovsky, 2019). In the initial stages or in milder forms of the syndrome, patients may subjectively feel "*asymptomatic at rest, but develop pain, weakness, heaviness or tiredness in the legs after standing erect or walking*" (Goh et al, 2004, page 243).

The cauda equina syndrome usually involves herniated discs or vertebral fractures in the lumbar region at levels L5-S1, e.g., due to physical injuries in accidents that affect both women and men (Giannini, et al., 2015). Predisposing factors might include age-related degeneration, spinal infections or inflammations, birth abnormalities, spinal hemorrhages or other injuries, and spinal tumors (Malol et al, 2019). They may manifest as a series of urogenital and neuromuscular symptoms in the homonym "cauda equina syndrome" (Quaile, et al., 2015).

Muh-Shi Lin's team (2013) reported on two patients (male, age 27 and female, age 25) with an acute form of cauda equina syndrome with fractures detected on CT scan and MRI that required prompt surgical intervention (L4–S1 laminectomies with transpedicle screws and rod system instrumentation, and removal of bone fragments).

Another case was recently described as follows "*A 50 year old lady injured in an MVA 18 months ago still reports numerous post-concussive symptoms as well as the following symptoms of the cauda equina syndrome: numbness in her left leg and in the "saddle area," severe urinary incontinence, instances of moderate loss of muscular control over her left leg, and severe tingling and some loss of feeling in her left leg. Due to her residence in a very remote and medically underserved area, a physician treated her symptoms with opiate based analgesics which partly obscured some of her symptoms and delayed the diagnosis*"(Cernovsky, 2019).

In Canada, post-MVA patients are often evaluated by specialized medical psychologists after many weeks or even several years following their accident. Ideally, such psychological evaluations should be based on standardized quantitative measures of the typical post-MVA polytraumatic symptom pattern. This pattern includes subjectively experienced post-

concussive symptoms, pain, and pain related insomnia, subjectively perceived symptoms of whiplash, PTSD, depression, and anxiety. With some patients, it might be important in such assessments to include a brief screening measure of the subjectively perceived persistent signs of the cauda equina syndrome, or of a persistent tendency towards that syndrome, to initiate referral to neurology. This referral would facilitate an expert diagnosis via MRIs of the lumbo-sacral area, and other specialized neurological investigations, in order to avoid the condition remaining undiagnosed and untreated with symptoms worsening in some cases due to age related bone loss or exacerbation due to new injuries by strenuous physical work or accidents. The present study aimed at developing such brief screening tool.

Method

De-identified archival data from the last 2 years on 67 patients injured in serious MVAs were available. They were all from Ontario, Canada, their age ranged from 19 to 67 with the average at 38.8 (SD=11.7). The sample consisted of 25 men and 42 women. On average, their MVA had occurred approximately 42.2 weeks ago (SD=29.1). They had all retained a personal injury lawyer due to administrative delays with insurance compensations. In their MVA, 54 were the drivers, 12 were passengers, and one rode a motorcycle that collided into a car. In 28 cases, the collision involved an impact to the side of the vehicle, in 19 to the back of the vehicle, and in 18 cases the impact was frontal or combined. The majority of the patients (46 of 67, i.e., 68.7%) had no previous serious MVAs associated with injuries, 18 patients (26.9%) had one such previous MVA, 2 patients (3.0%) had 2 such prior MVAs, and one patient (a long distance trucker) was in 5 previous accidents.

All patients were asked if they experienced tingling or numbness that extended from the area over the buttocks, over the area on or between upper thighs, and to the area over the lower belly. They were asked to rate the tingling and numbness on a scale from 0=not present, 1=no longer present (i.e., if the symptom was present only in initial stages of their recovery from the MVA, but not any longer), 2=mild, 3=moderate, and 4=severe. All patients also provided ratings, on the same rating scale, of bladder control problems, bowel control problems, and problems caused by instances of reduced or impaired muscular control over their legs: these last 3 items are a part of the Post-MVA Neurological Symptoms (PMNS) scale (see Cernovsky et al., 2019).

Table1. *Patients' scores on clinical measures*

	N	Minimum	Maximum	Mean	SD
Post-MVA Neurological Symptoms (PMNS) scale	67	0.0	50.0	21.1	11.0
Brief Pain Inventory - worst pain (scale from 0 to 10)	67	4.0	10.0	8.3	1.2
Brief Pain Inventory - least pain (scale from 0 to 10)	67	2.0	9.0	4.4	1.6
Brief Pain Inventory - average pain (scale from 0 to 10)	67	3.0	9.0	6.4	1.3
Insomnia Severity Index	67	15.0	28.0	24.3	3.7
PTSD checklist for DSM5 (PCL-5)	29	34.0	79.0	57.2	13.4
Rivermead Post-Concussion Symptoms scale	67	22.0	63.0	46.9	9.4
Immediate Concussion Symptoms scale	66	1.0	8.0	4.7	1.8
Driving Anxiety Questionnaire	59	43.0	121.0	93.7	21.3
Whetstone Vehicle Anxiety Questionnaire	56	24.0	92.0	65.3	18.0
Automobile Anxiety Inventory	51	9.0	23.5	14.6	2.5

The pain locations were recorded separately for the following 4 areas: lower back, gluteus area, hips, upper leg/thighs, lower leg, neck, and the head.

They were also asked to provide separate ratings for the tingling and for the numbness in their legs and in their gluteus area, with "Yes" scored as 1 and "No" scored as 0.

The patients were administered the Brief Pain Inventory (Cleeland, 2009), Rivermead Post-Concussion Symptoms scale (Eyres et al., 2005), the Post-MVA Neurological Symptoms scale (Cernovsky et al., 2019), Insomnia Severity Index (Morin, 2011), items 10 to 12 of the Whiplash Disability Index (i.e., items to rate depression, anxiety, and anger on a scale from

0=no symptom to 10=symptom always present, see Pinfold, 2004), the Immediate Concussion Symptoms (ICS) scale (Cernovsky et al. 2018), and 3 measures of driving anxiety: Whetstone Vehicle Anxiety Questionnaire (Whetstone et al, 2020), Steiner's Automobile Anxiety Inventory (Steiner and Cernovsky, 2020), and the Driving Anxiety Questionnaire (see text and psychometric data in Whetstone et al., 2020). Clinical files of 29 patients in this sample also included the scores on the PTSD checklist for DSM5 (PCL-5), see Weathers et al. (2013).

The patients' scores on these various psychological measures are summarized in Table 1.

Results

Frequencies of the Symptoms of Cauda Equina Syndrome

The key variables for determination of the tendency towards cauda equina syndrome were

(1) tingling extending over the gluteus, between the legs or on upper thighs, and over lower abdomen,

(2) numbness extending over the gluteus, between the legs or on upper thighs, and over lower abdomen,

(3) reduced control over leg muscles,

(4) impaired control over the urinary bladder, and

(5) impaired bowel control.

This screening scale is reproduced in full in Table 2.

Table2. *Screening scale for cauda equine syndrome*

Cauda Equina Scale to Determine if a Referral to Neurology is Appropriate					
	Symptom Absent =0	Symptom No longer present =1	Mild Symptom =2	Moderate Symptom =3	Severe Symptom =4
Tingling extending over the gluteus, between the legs or on upper thighs, and over lower abdomen	0	1	2	3	4
Numbness extending over the gluteus, between the legs or on upper thighs, and over lower abdomen	0	1	2	3	4
Reduced control over leg muscles	0	1	2	3	4
Impaired control over the urinary bladder	0	1	2	3	4
Impaired bowel control	0	1	2	3	4

The data in Table 3 include the observed frequencies (%) for each of these 5 symptom areas, i.e., the 5 key variables.

These five variables were added to form the ***total index of tendency towards cauda equina syndrome***. The score on that variable theoretically can range from 0 to 20. This composite score ranged from 0 to 20 points, with the average at 4.3 (SD=4.8).

Table3. *Frequencies of reported symptoms of cauda equina syndrome in our patient sample (N=67)*

	Absent =0	No longer present =1	Mild =2	Moderate =3	Severe =4	Average score (SD)
Tingling extending over the gluteus, between the legs or on upper thighs, and over lower abdomen	76.1%	6.0%	1.5%	7.5%	9.0%	0.7 (1.4)
Numbness extending over the gluteus, between the legs or on upper thighs, and over lower abdomen	80.6%	3.0%	3.0%	6.0%	3.0%	0.6 (1.2)
Reduced control over leg muscles	44.8%	3.0%	26.9%	17.9%	7.5%	1.4 (1.4)
Impaired control over the urinary bladder	62.7%	7.5%	11.9%	9.0%	9.0%	0.9 (1.4)
Impaired bowel control	76.1%	3.0%	6.0%	10.4%	4.5%	0.6 (1.2)

Thus, moderate to severe tingling extending over the gluteus, between the legs or on upper thighs, and over lower abdomen was reported by 16.5%, moderate to severe numbness extending over this same area by 9.0%, moderately to severely reduced control over leg muscles by 25.4%, moderately to severely impaired bladder control by 18.0%, and moderately to severely impaired bowel control by 14.9%. These 5 symptoms were examined in quantitative assessments of prodromal signs of the cauda equina syndrome in the present study.

Locations of Pain, Tingling, and Numbness

The proportions of patients reporting pain in the following areas were: lower back (79.1%), hips (86.6%), gluteus (23.9%), upper leg/thighs (31.3%), knees (38.8%), lower leg (32.8%). The other patients reported absence of pain in these areas.

Tingling in leg or legs was reported by 50.7% of the patients, tingling over gluteus by 31.3%, numbness in leg or legs was reported by 47.8% of the patients, and numbness over gluteus by 25.4%. However, as shown in Table 3, only less than 20% of patients still experienced, since their accident, tingling or numbness that was actively spread over all of the following areas, including the gluteus, between the legs or on upper thighs, and over lower abdomen.

Statistical Properties of the Cauda Equina Syndrome Index

As already explained, the index was calculated by adding 5 variables: 1) tingling extending over the gluteus, between the legs or on upper thighs, and over lower abdomen, (2) numbness extending over the gluteus, between the legs or on upper thighs, and over lower abdomen, (3) reduced control over leg muscles, (4) impaired control over the urinary bladder, and (5) impaired bowel control.

The Cronbach alpha coefficient of internal consistency of this 5 item scale was 0.77, i.e., satisfactory. Other properties of the scale are summarized in Table 4.

Table4. *Item to scale relationships*

	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Scale Mean if Item Deleted	Scale Variance if Item Deleted
Tingling in cauda area	.72	.59	3.5	15.1
Numbness in cauda area	.70	.64	3.7	15.6
Reduced leg control	.73	.56	2.9	15.3
Impaired bladder control	.77	.43	3.3	16.6
Impaired bowel control	.74	.53	3.6	16.5

The intercorrelations of the 5 items are reported in Table 5.

Table5. *Intercorrelations of items of cauda equina syndrome scale*

	Tingling	Numbness	Leg control	Bladder control	Bowel control
Tingling		.87	.48	.16	.27
Numbness	.87		.47	.17	.35
Leg control	.48	.47		.38	.34
Bladder control	.16	.17	.38		.64
Bowel control	.27	.35	.34	.64	

All of these correlations are significant at $p<.05$ (1-tailed), except for those of bladder control to numbness or tingling over the entire area of cauda equina (impaired bladder control could, of course, have also other etiologies than those involved in cauda equina syndrome).

Convergent Validity of the Cauda Equina Syndrome Scale

Theoretically, the likelihood of cauda equina syndrome increases with severity and intensity of the impact of the vehicular collision. This also symmetrically increases with the number and intensity of reported

post-concussive and whiplash symptoms, as well as with an increase in reported post-MVA pain.

Since persistent pain causes insomnia and these two factors are then likely to jointly contribute to perpetuation of symptoms of generalized anxiety, depression, anger/irritability, PTSD, and driving anxiety, these correlations are also calculated and are listed in Table 6.

Table6. *Correlations of the cauda equina syndrome scale to other post-MVA symptoms*

	Pearson correlation *P values at p<.05 (1-tailed)*	Spearman's rho *P values at p<.05 (1-tailed)*
Subjective symptoms of whiplash (scores on the PMNS scale)	.81, p<.001	.77, p<.001
Subjective symptoms of whiplash (scores on the PMNS scale), but without the following items: leg, bladder, and bowel control (these 3 items are also part of the cauda equina syndrome scale)	.69, p<.001	.63, p<.001
Rivermead Post-Concussion Symptoms scale	.40, p<.001	.39, p=.001
Immediate Concussion Symptoms (ICS) scale	.01, not significant	.02, not significant
Loss of Consciousness (LOC) at the time of the collision	-.06, not significant	-.03, not significant
Insomnia Severity Index (ISI)	.43, p<.001	.42, p<.001
Brief Pain Inventory (BPI) - worst pain rating	.34, p=.002	.35, p=.002
Brief Pain Inventory (BPI) – least pain rating	.33, p=.003	.37, p=.001
Brief Pain Inventory (BPI) – average pain rating	.42, p<.001	.46, p<.001
Depression rating (item 10 of the Whiplash Disability Questionnaire)	.33, p=.003	.33, p=.003
Anger rating (item 11 of the Whiplash Disability Questionnaire)	.29, p=.009	.27, p=.015
Anxiety rating (item 12 of the Whiplash Disability Questionnaire)	.18, not significant	.19, not significant
Age (in years)	.01, not significant	.06, not significant
Gender	-.04, not significant	.02, not significant
N of weeks since the accident	-.09, not significant	-.05, not significant
N of prior serious MVAs	.13, not significant	.21, p=.047
Automobile Anxiety Inventory, authored by Leo Steiner (N=51)	.14, not significant	.15 not significant
Whetstone Vehicle Anxiety Questionnaire, authored by James Whetstone (N=56)	.37, p=.003	.34, p=.006
Driving Anxiety Questionnaire (N=59)	.33, p=.006	.28, p=.016
PTSD checklist for DSM5 (PCL-5) – data from only 29 patients	.49, p=.003	.32, p=.048

Since some experts prefer parametric and some recommend nonparametric correlations, we calculated both the Pearson r and Spearman's rho: our results with these two correlational statistics are very similar.

Convergent validity of the 5 item cauda equina syndrome scale is supported by its significantly high correlation to whiplash symptoms, as subjectively perceived and reported by the patients (PMNS scores, see Cernovsky et al., 2019). The correlations remained high and significant even after the 3 items common to the whiplash symptoms scale (PMNS) and to cauda equina syndrome scale were removed from the PMNS.

Convergent validity is also supported by significant positive correlations of the cauda equina syndrome scale to ratings of pain, insomnia (ISI), post-concussive symptoms (Rivermead scale), to ratings of post-accident depression and anger, lingering symptoms of PTSD (scores on PCL-5), and scores on the Driving Anxiety Questionnaire and on Whetstone Vehicle Anxiety Questionnaire.

The scores on the cauda equina syndrome scale were unrelated to gender. No significant relationship was noted to age, however, the highest age in this group of patients was only 67. The results could be different if re-evaluated on a group of much older persons.

The scores for cauda equina syndrome were not significantly correlated to the number of weeks since the accident. Our sample consisted only of patients who still suffered from intense post-accident symptoms. No significant correlation was present to the number of prior serious MVAs when calculated with Pearson r (r=.13, p>.05); the corresponding Spearman's rho was very low and barely met the criterion of significance (.21, p=.047).

The cauda equina syndrome scores were not significantly correlated to the self-ratings of generalized anxiety: the correlation coefficient was in the expected direction, but was too low to reach the significance level of p<.05, 1-tailed.

The cauda equina syndrome scores were not significantly correlated to the retrospective ratings, by the patients, of their immediate symptoms of concussion at the time of the accident (ICS scale scores), and they were also unrelated to the patients' reports of loss of consciousness (LOC) during the MVA, perhaps due to the excessive length of time elapsed since the accident during which time other factors might have influenced the level of each patient's physical recovery.

The cauda equina syndrome scores were also unrelated to driving anxiety scores as assessed by Steiner's questionnaire, perhaps because it consists mainly of items that compare past levels to current levels of fear of driving.

Correlations to Reports of Pain in Specific Locations

These correlations are summarized in Table 7. Only correlations > .20 are significant at p<.05, 1-tailed.

Table7. *Correlations among pain locations*

	Cauda Equina Syndrome Scale	low back	hips	upper leg	gluteus	lower leg	knees
low back	.39		.26	.19	.29	.13	.18
hips	.32	.26		.45	.56	.36	.31
upper leg	.27	.19	.45		.45	.35	.32
gluteus	.09	.29	.56	.45		.21	.20
lower leg	.40	.13	.36	.35	.21		.42
knees	.31	.18	.31	.32	.20	.42	
upper back	.05	.10	.00	-.03	.02	-.08	-.07
shoulders	-.01	.12	-.05	-.02	.12	.09	.13
neck	.01	.20	-.10	-.08	.04	.03	-.01
head	-.03	.13	-.12	.07	.03	-.04	.11

The correlation matrix suggests that, in this sample of patients, pain over the gluteus seems less important in the syndrome of cauda equina. The pain in the lower back is correlated as a cluster with pain in the legs (upper, lower, or knees) and hips. The pain over gluteus is correlated mainly with hip pain and upper leg pain.

Pain in the upper back, shoulders, neck, and headaches might form another correlational cluster relatively independent of the one associated with lower back pain. For example, headaches correlated significantly with neck pain (r=.52), shoulder pain (r=.39) and upper back pain (r=.21).

Discussion

The cauda equina syndrome can vary in severity, scope, development, and incipient history. Our 5 item screening scale for cauda equina syndrome shows adequate psychometric characteristics and satisfactory convergent validity. Our scale is not intended or

suitable to provide a neurological diagnosis of cauda equina syndrome. Some neurosurgeons reserve such a neurological diagnosis only for cases requiring prompt or timely surgical intervention. Our scale only detects and evaluates the prodromal signs, with the objective of early prevention of the development of acute and more severe cauda equina syndrome and facilitating future research. It can be administered by family physicians, medical psychologists, or other medical specialists as a screening test for related persistent symptoms and as a first step toward requesting lumbo-sacral MRIs or referral to a specialized neurologist for further neurological investigation and therapy.

Statistical comparisons of scores on our screening scale to MRI results and to results of other neurological investigations are much needed.

Pain is an important warning signal for the patient to avoid strenuous activities. When patients with injuries to lumbosacral spine (i.e., those who may also experience signs of the cauda equina syndrome) are prescribed opiate analgesics to reduce pain, some of such pain de-sensitized patients might seriously exacerbate their existing neurological injuries through excessive physical chores. Opiate analgesics may obscure important diagnostic cues and delay the diagnosis and as well as early therapeutic management.

Conclusions

Our statistics confirm the presence of adequate psychometric characteristics and satisfactory convergent validity of the screening scale for persistent symptoms of the cauda equina syndrome. This scale may be considered as a *brief preliminary diagnostic screening tool* for post-accident patients by family physicians, medical specialists, or by specialized medical psychologists, to precede a referral for extensive neurological investigations, such as lumbo-sacral MRIs and other diagnostic procedures.

References

[1] Cernovsky ZZ. Cauda equina syndrome in a patient injured in a car accident. *International Journal of Psychiatry Sciences*. 2019; 1(1):20-22.

[2] Cernovsky Z, Istasy P, Bureau Y, & Chiu S. Scale for retrospective assessment of immediate concussion symptoms. *Mental Illness*. 2018; 10(2): 70-71, and Appendix.

[3] Cernovsky ZZ, Istasy PVF, Hernández-Aguilar ME, Mateos-Moreno A, Bureau Y, and Chiu S. Quantifying Post-Accident Neurological Symptoms Other than Concussion. *Archives of Psychiatry and Behavioral Sciences*. 2019; 2(1): 50-54.

[4] Cleeland CS. *The Brief Pain Inventory - User Guide*. Houston, TX: The University of Texas - M. D. Anderson Cancer Center, 2009.

[5] Comer C, Finucane L, Mercer C, Greenhalgh S. Shades of grey - The challenge of 'grumbling' cauda equina symptoms in older adults with lumbar spinal stenosis. *Musculoskeletal Science & Practice*. 2019;12:102049. doi: 10.1016/j.msksp.2019.102049.

[6] Eyres S, Carey A, Gilworth G, Neumann V, Tennant A. Construct validity and reliability of the Rivermead Post-Concussion Symptoms Questionnaire. *Clinical Rehabilitation*. 2005; 19: 878-87.

[7] Giannini C, Spengel KC, Aleff PCA, Rivera M, & Wald JT. 24-Year-Old Woman with Recent Onset Back Pain. *Brain Pathology*. 2015; 6(25):786-787.

[8] Gitelman A, Hishmeh S, Morelli BN, Joseph SA Jr, Casden A, Kuflik P, Neuwirth M, Stephen M. Cauda equina syndrome: a comprehensive review. *American Journal of Orthopedics*. 2008; 37(11): 556-62.

[9] Goh KJ, Khalifa W, Anslow P, Cadoux-Hudson T, Donaghy M. The Clinical Syndrome Associated with Lumbar Spinal Stenosis. *European Neurology*. 2004; 52:242-249. doi: 10.1159/000082369

[10] Kunam VK, Velayudhan V, Chaudhry ZA, Bobinski M, Smoker WR, & Reede DL. Incomplete Cord Syndromes: Clinical and Imaging Review. *Radiographics*. 2018; 38(4):1201-1222.

[11] Lin MS, Lin HY, Hung KS, Lin TJ, Wang YC, Chiu WT, Kung WM. Seat belt syndrome with cauda equina syndrome: two unique cases in the same motor vehicle accident. *Spine (Phila Pa 1976)*. 2013; 38(25):E1624-7.

[12] Mallol D, Taveras R, Hartman J, et al. Cauda Equina Syndrome in a Patient with Intradural Schwannoma at the Same Level as an Acute L2 Compression Fracture. *Cureus*. 2019; 11(8): e5492. DOI 10.7759/cureus.5492

[13] Morin CM, Belleville G, Bélanger L, and Ivers H. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep*. 2011; 34:601-608.

[14] Orendácová J, Cízková D, Kafka J, Lukácová N, Marsala M, Sulla I, Marsala J, Katsube N. Cauda equina syndrome. *Progress in Neurobiology*. 2001;64(6):613-37.

[15] Pinfold M, Niere KR, O'Leary EF, Hoving JL, Green S and Buchbinder R. Validity and internal consistency of a Whiplash-Specific disability measure. *Spine*. 2004;29(3): 263-268.

[16] Quaile A. Cauda equina syndrome - the questions. *International orthopaedics*. 2019;43(4):957-961.

[17] Ridley LJ, Han J, Ridley WE, & Xiang H. Cauda equina: Normal anatomy. *Journal of Medical Imaging and Radiation Oncology*. 2018;62:123-123.

[18] Spector LR, Madigan L, Rhyne A, Darden B 2nd, Kim D. Cauda equina syndrome. *Journal of the American Academy of Orthopedic Surgeons*. 2008; 16(8): 471-9.

[19] Steiner L, and Cernovsky Z. Convergent Validity of Leon Steiner's Measure of Amaxophobia. *International Journal of Psychiatry Sciences*. 2020; 3(1): 45-50.

[20] Weathers FW, Litz BT, Keane TM, Palmieri PA, Marx BP, & Schnurr PP. *The PTSD Checklist for DSM-5 (PCL-5)*. The National Center for PTSD, US Department of Veterans Affairs, Washington, DC, 2013. www.ptsd.va.gov.

[21] Whetstone JP, Cernovsky Z, Tenenbaum S, Poggi G, Sidhu A, Istasy M, Dreer M. Validation of James Whetstone's Measure of Amaxophobia. *Archives of Psychiatry and Behavioral Sciences*. 2020;3(1):23-33.

Citation: **Zack Z. Cernovsky, Alejandro Mateos-Moreno, L. Kola Oyewumi, et al**. *A Brief Rating Scale of Subjective Persistent Symptoms of the Cauda Equina Syndrome for Family Physicians or Medical Psychologists. Archives of Community and Family Medicine. 2020; 3(2): 58-66.*

Copyright: © *2020* **Zack Z. Cernovsky, Alejandro Mateos-Moreno, L. Kola Oyewumi, et al**. *This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.*