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Invited Abstracts

Quality of Life - Research Needs for Pediatric Spinal Cord Lesions - The PEPSCI Study

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Objectives: The functional deficits of Pediatric onset Spinal Cord Injury (SCI), i.e. motor and sensory dysfunction below the affected level, as well as symptoms of neurogenic bladder and bowel, were not well studied until recently[1]. Spina bifida, although rare, is the most common complex birth defect compatible with life[2], resulting to chronic health conditions related with Spinal Cord Lesions.

Health related quality of life (QOL) is an important clinical outcome measure of the individual's perception for the impact of an illness/disease on his/her well-being[2]. Children suffering from Spinal Cord Lesions and their families/caregivers, in Greece as part of a European collaboration (PEPSCI- Pan-European Pediatric Spinal Cord Injury Survey), were surveyed.

Methods: The multi-center international survey was designed by the PEPSCI Collaboration and a cross sectional study took place for children with SCI and their parents, of a pediatric outpatient rehabilitation facility in Athens. Demographics, quality of life[3], health and life domains (H&LDQ) data as well as neurological impairment information were collected and analyzed.

Results: The demographics for the total of 13 children, average age 9,03 (+/- 5) years, are shown on Table 1.

Table 1.

Demographics	Children
Age at interview	9,06 (5,1)
Race	White
Sex	
male	46,1% (6)
female	53,9 (7)
Education level	
Infant dept	23,1% (3)
Nursery school	7,7% (1)
Primary school	46,2% (6)
Secondary school	15,3% (2)
University	7,7% (1)
Level of injury	
Paraplegia	61,5% (8)
Cauda equina	38,5 % (5)
Extent of injury	
Complete	30,8% (4)
Incomplete	69,2 % (9)
Lesion aetiology	
Fall	7,7% (1)
Tumour	7,7%% (1)
congenital	84,6% (11)

Research priorities for parents and children have also been outlined (Tables 2, 3 and 4).

Table 2.

Top 4- least satisfaction (YOUTH 8-12)				
Question	No of answers	Average of answers (1-5)	SD	%
27. Your ability to bathe yourself	3	3,67	2,31	73,3%
29. Your ability to stand up from a chair or remain standing	3	3,67	2,31	73,3%
33. Your ability to empty your bladder	3	3,67	2,31	73,3%
2. How easy is it for you to do the things you need	3	4	1,73%	80%

Table 3.

Top 6- average (YOUTH 13-25)				
Question	No of answers	Average of answers (1-5)	SD	%
L19. Support services at home (incl therapies)	5	4,2	1,8	84
L26. Your present situation and your future expectations relative to intimate relationships	5	4,2	1,8	84
L27. Your expectations in relation to having children and the parental role	5	4,2	1,8	84
H13. Dealing with menstruation	5	4,2	1,8	84
L2. How you feel, in relation with emotions	9	3,9	1,5	78
L4. Your physical level and exercise	9	3,9	1,8	78

Table 4.

Top 5- average (Parents)				
Question	No of answers	Average of answers (1-5)	SD	%
H14. Your child's sexual activity	14	4,5	1,2	90
H13. Your child's management of menstruation	15	4,5	1,2	89,3
H9. Your child's ability to walk	28	4,1	1,4	82,9
H7. Your child's ability to move the lower extremities	32	4,1	1,5	81,9
H11. Your child's bladder management	31	4,0	1,4	80,6

Conclusions: Our preliminary results of QoL data proved to be similar with published findings of other countries. However, the need for nationwide data is indisputable depicting the need for interventions that would also help for a better quality of life of children and adolescents and their families and the smooth transition towards adulthood as well.

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Health and Long-living after Spinal Cord Injury in Childhood

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Spinal cord injury (SCI) in childhood can impact physical and psychological development, health and long-living. Upper cervical spine injuries, more sustained with young children, have a higher mortality rate. Life expectancy appears to be slightly lower than that of otherwise comparably injured persons who suffered their injuries as adults[1]. Nonetheless, persons who are injured young can enjoy relatively long-life expectancies, ranging from approximately 83% of normal life expectancy for persons with minimal deficit incomplete injuries to approximately 50% of normal in high-cervical-level injuries without ventilator dependence. Spinal deformity such scoliosis was shown to be associated with younger age at onset and quadriplegia[2]. Neuropathic[3] and musculoskeletal chronic pain, such as shoulder pain[4], has a significantly smaller impact on daily activities and fewer visits to the physician.

There is a changing nature of play[5] significant with decreased outdoor recreation and increased dependence in electronic media. In self-perception, these patients score higher for the dimensions of mental functioning, communicating, social participation and seeing and lower for moving, working, sleeping and eating.

Secondary health conditions[6] from SCI as hyponatremia and autonomic dysreflexia in a person with tetraplegia, osteoporosis, sexual dysfunction, increased danger of pregnancy[7], decreased cardiovascular, respiratory and fitness performance, polypharmacy[8], urinary tract infection, bowel dysfunction threaten also these patients. However, bowel dysfunction[9] seems to cause only mild problems in their social life.

Those with a pediatric SCI reported social participation[10], higher adult employment rates. and minutes per day of moderate-to-vigorous physical activity than those who sustained an SCI in adulthood. No significant differences were found for the measures of depression, perceived health status or life satisfaction.

The rehabilitation after SCI in childhood must be addressed in a biopsychosocial manner and include various disciplines.

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Hereditary Spastic Paraplegias

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The term 'Hereditary Spastic Paraplegias' (HSP) refers to a heterogenous group of disorders characterized by progressive spasticity of the lower limbs due to degeneration of the corticospinal tracks. It may present at any age from infancy to adulthood. The mode of inheritance is *autosomal* dominant in most cases, however autosomal recessive, or X-linked genetic transmission have been reported; finally, 13-40% of cases are sporadic. HSP was first described by Adolf Strümpell and Maurice Lorrain in the late 19th century, thus it is commonly referred as Strümpell - Lorrain syndrome[1].

The overall prevalence is 3:100.000[2], however many cases may be misdiagnosed. Pure HSP[3] is the most common form of the syndrome, comprising about 75-80% of the cases; most of these cases are autosomal dominant. Complicated forms of HSP include additional clinical features e.g. amyotrophy, mental retardation, epilepsy, ataxia, optic atrophy; in these cases, autosomal recessive is the most common mode of inheritance.

The heterogeneity of HSP reflects to the large number (77) of genetic loci that have been identified to date; they are designated as SPG and numbered in order of their discovery[4]. Impaired cellular membrane trafficking, more particularly, axonal transport of macromolecules and organelles, is the best characterized genetic mechanism of HSP with mitochondrial dysfunction being the second most important process. In terms of pathology, HSP is characterized by degeneration of the long tracts of the spinal cord, i.e. the corticospinal tract and, to a lesser extent, the posterior columns. This culminates in the key clinical aspects of HSP: spasticity of the lower limbs, followed by a - usually less severe - weakness, urinary urgency and decreased vibration sense.

The classic symptom of HSP is progressive difficulty in walking. The age of symptom onset, the rate of symptom progression, and the extent of disability are variable even in the same family. Some patients eventually may require the use of a wheelchair, while others may be able to walk unassisted after several decades. Urinary problems may also appear in the late stages. Physical examination reveals pyramidal signs in the lower limbs.

Differential diagnosis is the most important challenge, especially regarding treatable causes of progressive spastic paraparesis[5]. These include various structural, inflammatory, and infectious causes, vitamin B12 deficiency, and copper deficiency. Adrenoleukodystrophy, DOPA responsive dystonia, spinocerebellar ataxias and primary lateral sclerosis may also be included in the differential diagnosis. A detailed developmental and family history can provide important clues, in addition to laboratory tests, neuroimaging[6] and neurophysiological studies. Genetic testing may help confirm the diagnosis.

The management of HSP is mainly symptomatic. Oral antispasmodics and physical therapy have an established role. Intrathecal baclofen can be effective in more advanced cases. Use of orthotics and botulinum toxin injections whenever necessary may also help motility. With current treatment, the median disease duration until loss of

independent walking is 22 years[7]. However, after 40 years almost three quarters of the patients may be able to walk with a walking aid. Genotype-specific therapies including treatments attempting to address pathophysiological mechanisms may be the next step.

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Update on Neurological Examinations of Individuals with Spinal Cord Injury

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Clinical presentations and functional consequences of an acute spinal cord injury (SCI) are variable; therefore, the initial evaluation of newly injured individuals and documentation of initial neurological deficits of patients with an acute SCI is a key factor in determining triage, defining therapy, and predicting prognosis. The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) or more commonly referred to as the ASIA Impairment Scale (AIS), was developed in collaboration between the American Spinal Injury Association (ASIA) and the International Spinal Cord Society (ISCoS) as a universal classification tool for SCI based on a standardized sensory and motor assessment[1-3].

Initially, based on recommendations from Dr. H. Frankel, the severity of SCI was determined by a 5-point severity scale (known as the Frankel scale). Despite its utility as a clinical tool, numerous methodological shortcomings of the Frankel scale were recognized. The most significant change occurred in 1992 when the ASIA classification committee conducted major revisions of the International Standards for Neurological and Functional Classification of Spinal Cord Injury Patients (International Standards).

Over the last two decades, the ISNCSCI assessment has undergone several revisions with its latest 8th edition released during the 2019 ASIA annual meeting in Honolulu. The newest 2019 edition is based not only upon comments, questions, and suggestions from the international SCI community, clinicians and researchers, but also integrates recently available evidence and structured feedback from ISNCSCI training courses. The following changes have been introduced with the 2019 ISNCSCI edition:

- A new taxonomy for documentation of non-SCI related impairments is introduced.
- The Zone of Partial Preservation (ZPP) definition has been refined.

Presently, the ASIA International Standards Committee and the Education Committee are working to implement these new changes into an online training tool (InSTeP) and to prepare a manuscript for submission to Spinal Cord that will include all the latest changes.

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Long-term Follow-up of Persons with Spinal Cord Injury

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Long term follow up of persons with spinal cord injury (SCI) becomes more important as life expectancy after SCI has increased for the last decades[1].

The awareness of the possible complications seen after SCI and premature aging of this group should always be kept in mind during the follow-ups[2]. There are many challenges for the clinicians when managing chronic problems associated with SCI. Most of the time chronic SCI presents multisystem management problems to the clinician and needs mutidisiplinary approaches[3].

In the last decades many promising development have occurred in the management of chronic SCI; use of intrathecal baclofen (ITB) and botulinum toxin injections for spasticity, use of botulinum toxin for detrusor overactivity, use of pregabalin and neuromodulation for neuropathic pain, use of robotic devices for gait training and upper extremity functions and surgical rehabilitation for the improvement of extremity functions.

Here I present a case with chronic SCI and discuss all the challenges we had by means of medical, functional, psychological and social aspects during the long term follow up. He was 14 years old when he sustained a C4 fracture due to a motor vehicle accident. After having a stabilization operation, he was transferred to the rehabilitation unit. During our follow up in the last five years, he had ITB pump and botulinum toxin injections. Complications due to ITB pump, neurogenic bladder and bowel, neuropatic pain, pressure sores, scoliosis, autonomic dysfunctions were the other main problems that we had to deal with. He has C4 AIS C injury and he is dependent to wheelchair. We encouraged him to continue his education and he is in the 4th grade of high school now.

We try to keep the patient's and the cargivers' compliance to the long term follow up course as to improve his functional independence and quality of life.

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Users Perspectives Serving New Technology in Rehabilitation

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Over the last years a wave of innovation with novel scientific approaches has emerged research on new technology in neurorehabilitation, especially neuroprosthetics and robot-assisted therapies.

This new technology enables individuals physically disabled to restore lost functions. Thoroughly, real needs and desires need to be considered in order to understand how this technology can be accessible and useful to the end user[1].

Research studies mostly evaluate effectiveness and only few of them really focus on the definition of guidelines for an effective selection of parameter values or a better timing of therapy administration, both tailored on the patients' capacities and needs, aiming at the recovery of physiological movement patterns. A common feature of these neurorehabilitative approaches is the need for intensive, repetitive, and task-oriented treatments aiming theoretically to increase the efficacy of rehabilitation and to optimize functionality. Nevertheless, their results are still inconsistent and premature to make solid recommendations about their clinical use and their proper role[2].

Only few data exist on users perspectives[1] whereas understanding the role of technology as an interaction between person, environment and technology seems really important. Assumptions, expectations and responses are highly individual and influenced by varying needs, opportunities, preferences and past experiences with, and exposure to such technology. Hence, personal factors are important for meanings assigned to assistive technology and for technology use[3].

The analysis of the psychological and physical impact of such technology on the patient is crucial in terms of clinical appropriateness of such rehabilitation intervention and acceptability of such technology[4].

People with physical disabilities experience many changes to their bodies after a loss of volitional movement, of sensation, and generally of functionality. Learning about how individuals with physical disabilities experience their bodies and the distinct physical changes that occur to the body, resulting in some loss in function, as well as the adjustment to these changes, could provide essential information needed in rehabilitation strategies and new technology design[5].

Furthermore, fear is crucial for acceptance and participation in new technology research[2]. Managing confidence and trust in assistive technology is important for the interaction with the patient in therapy. The context plays a key role when measuring trust in new technology and a bottom-up approach, emphasizing the user perspective and the context of their interaction, is the foundation for future design[6,7].

Ongoing and future research studies should focus in end user needs and expectations in order to promote new technology design. Additionally, future research should also focus on the effect of using assistive technology at home and in the community, in terms of quality of life improvement[8].

It is also important to balance excitement about the possibilities of these innovative therapeutic choices with consideration of the ethical, legal and social dimensions of the use of these technologies[9].

End users need to be seriously involved in new technology design, provide insight priorities based on their perceived needs, as well as by collected information from their interaction with new technology[1,9].

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Quality of Life of Spinal Cord Injured Persons

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Spinal Cord Injury (SCI) is one of the most important causes of mobility disability which results from car and work accidents, from various forms of violence, from falls from a height, or from some sport activity. In Greece, SCIs have increased dramatically in recent years, due to an increase in car accidents. It is estimated that an average of 22.000 road accidents occur each year, with 32.000 injured of which 3.200-3.500 will end up with permanent disability[1]. It has been also observed that patients with mobility problems, which are the result of some serious injury as SCI, are prone to depressive and anxiety disorders; the suicide rate among individuals with SCI is about five times as high as the population at large. People with SCI tend to consider their physical, mental, and social health lower than non-disabled persons as their idea of the Quality of Life is deteriorating[2].

Physical disability, especially the one caused by mobility problems, is one of the major factors affecting one's health-related Quality of Life. Diminished mobility, loss of functional ability, complications of the underlying disease, and dependence on the family environment create additional difficulties in the family and social life of these individuals as well as mental problems and lack of self-esteem that often lead to social withdrawal[3]. The purpose of this presentation is to identify issues associated with Quality of Life after SCI. Quality of Life is closely related to independent living and the main concepts to be examined here are those of relationship, control of one's life, occupation, environmental context, new values and perspectives as well as self-worth.

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Combat Aging by Optimizing Vascular Health. What We Can Learn from Individuals with Spinal Cord Injury

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Introduction: Paralysis is an obvious and devastating consequence of spinal cord injury (SCI). However, secondary complications resulting from injury to the spinal autonomic nervous circuits result in life-threatening episodes of unstable blood pressure (BP)[1]. The transient increases in arterial BP which occur on average 11 times/day are common among individuals with high-level SCI[2,3] can elicit serious clinical consequences. There are strong clinical evidence that have shown that individuals with SCI not only have a staggering 3-4-fold increased odds/risk of stroke (six strokes/1000 person-years), but also from significant cerebrovascular dysfunction[4,5]. Multiple factors potentially could contribute to increased risk of stroke and cerebrovacsular dysfunctions in individuals with SCI.

Literature evidence: In animal models it was demonstrated that endothelial dysfunction and profibrotic stiffening of arteries play a key role in the development of cerebrovascular complications and therefore likely underpin the association between the majority of the mentioned behaviors/conditions and cerebrovascular diseases[6]. Furthermore, it is also demonstrated that in individuals with SCI repetitive transient hypertension (due to autonomic dysreflexia) is clearly a unique form of cerebrovascular decline compared with that resulting from chronic steady-state hypertension. The relative risk of cognitive impairment in persons with SCI is 13 times greater than that which has been documented in uninjured individuals[7,8].

Conclusion: In general, it is well recognized that individuals with SCI develop characteristics and medical problems commonly associated with the aging process at a much younger age. Physical inactivity, a sedentary lifestyle and unstable blood pressure control are major risk factors in developing cerebrovascular dysfunction and early morbidity and mortality in this population. From both, a functional and structural perspective, the cerebrovasculature is deleteriously impacted by chronic exposure to repetitive transient hypertension after SCI and the resulting cerebral hyperperfusion that most likely contributes to significant cognitive dysfunctions in these individuals.

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The Burden of Primary Care and its Impact in Healthcare Quality of Life of Individuals with Spinal Cord Injury

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Quality of life for individuals suffering from chronic diseases is highly depended on their access to primary care and ability to gain self-control and self-care over their illness. Individuals with spinal cord injury (SCI) face limited access to primary healthcare and receive fewer preventive services than able-bodied patients[1]. People with SCI present higher risk developing cardiovascular and endocrine dysfunction while literature presents evidence of the association between lifestyle and serious health issues of this patient population[2].

This presentation will focus on the needs of individuals with SCI related to self-care, the role of primary care services, programs and interventions of health education and health promotion, motivation to self-care and prevention of SCI related complications, in improving quality of care and quality of life. Issues such as physical inactivity, weight management, counseling on lifestyle changes and self-care are presented along with the goals to be set by primary care health services with respect of the levels of health risk prevention[3]. Last but not least, issues of primary care deficiencies will be addresses as to strengthen those settings being effective in delivering quality care programs and services to individuals with SCI.

In conclusion, well being and complications' prevention of individuals with SCI is highly related to both their quality of life as well as to how primary care settings are ready to meet the criteria of efficacy and become accessible to patients with SCI[4]. Individuals with SCI present multiple needs of health education as well as preventive care strategies, apart from their regular follow-up by the rehabilitation team. The collaboration of primary care services and the rehabilitation team in an interdisciplinary way is necessary during the long-term follow-up. Motivation of the individuals with SCI for self-care, can play a significant role in achieving well-being.

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"ANIMUS Kids Experience - Learn & Play"

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Introduction: The program "ANIMUS Kids Experience - Learn & Play" is a prototype, educational, experiential program that addresses children 6 to 8 years' old.

Aim: This program is aiming at sensitizing and familiarizing children and teachers with disability issues and social racism. It develops empathy, encourages acceptance and promotes friendship.

Description: A "neighbourhood" with 3-D small houses waits for the children to discover it. The children are separated in small groups and start exploring the houses. In every house, the children have the chance to meet a "hero" with a different kind of disability, to learn about disability and to create their own story. The program is implemented at specially designed spaces of our center that are friendly and safe for the children.

Sexes' Particularities in Persons with Spinal Cord Injury. Women Facing Special Problems

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Spinal cord injury (SCI) is a devastating condition that affects thousands of new individuals annually, mostly males. Gender has a possibly important, though indefinite and often under estimated impact on the physiology and pathophysiology of the central nervous system reflecting differences that are associated with demographic data, outcome, aging issues, and community integration of men and women with SCI.

Males are more likely to become tetraplegic (mostly because of vehicle accidents or violence related causes) at an earlier age (in their 20s and 30s), whereas females tend to be injured and become paraplegic later in their life (in their 50s or 60s)[1].

Experimental and clinical research has shown conflicting findings regarding the gender differences in outcome in specific SCI models suggesting that the effect of the gonadal sex hormones on neurologic recovery is still controversial[2]. Some studies have shown a female gender-related advantage in locomotor recovery, without a definite explanation of the cause of those better outcome scores (i.e. potential neuroprotective effect of estrogen)[3,4].

Aging with SCI make women more vulnerable to experience pain, fatigue, skin problems, deep venous thrombosis, depression, even commit suicide, or more willing to take medication for managing those conditions than men[5,6]. Female individuals appear to have also more complications associated with bowel and bladder function and greater subsequent social consequences (i.e. transportation problems) than male[5]. Due to hormonal changes, women with SCI have lower bone density, greater risk of fracture, and altered body composition compared with men. On the other hand, men report more health problems (i.e. diabetes) and more adaptive equipment changes[5].

Concerning societal participation, women report more environmental barriers across all domains of community integration compared to men, reflecting limitations in active lifestyle and well being[7].

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Sexual Health: Focus on Sexual Activity of Women with Spinal Cord Injury

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Spinal Cord Injury (SCI) impacts on female sexual function probably more than any other neurologic disorder. Sexual satisfaction and frequency of sexual activity are extremely affected[1].

There are two centers in the spinal cord that are involving in the sexual arousal response[2]. The Psychogenic sympathetic center is a pure Autonomic center, located from Lower Thoracic neurotomes to upper Lumbar ones (T11/12 - L2/3), is responsible for the provocation of psychogenic sexual response. The Reflexogenic Center includes Parasympathetic and Somatic fibers, from the Sacral spinal cord level (S2 - S4). At the same level are located the somatic-sensory innervation centers of the genitalia. The reflex arc consists of afferent sensory fibers from pudendal and dorsal clitoral nerve and efferent fibers that create the cavernous nerves (part of pelvic or inferior hypogastric plexus).

Regarding the orgasmic experience approximately only 50% of the women (of all the levels of SCI) can achieve an orgasm in a prolonged time of stimulation compared to able body population[3]. Women with Lower Sacral level of injury is less like to experience orgasm as the reflex arc of sexual response is not working efficiently.

Special consideration has to be taken in SCI women with lesions above T6, who are eligible for Autonomic Dysreflexia (AD). Sexual activity, especially powerful stimulation (by vibrators) can initiate an AD episode. AD candidates have to be well informed of this condition and be able to control their stimulation in an optimal way for their safety[4].

The knowledge of the SCI pathophysiology that affects sexual function is the key point for the optimal consultation from the part of physicians and other health care providers. Open-minded body exploration (with the potential use of toys and other devices) and mindfulness, is suggested as an efficient way for sexual health improvement[5].

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Women's Health after Spinal Cord Injury: Focus on Pregnancy and Breastfeeding

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Introduction: The majority of mothers with or without spinal cord injury (SCI) wish to breastfeed if possible. Human milk production and ejection are heavily reliant upon intact neurohormonal signalling, which involves sensory stimulation of the breasts[1]. Lactation dysfunction following SCI has been previously observed, but the influence of SCI on breastfeeding ability and behavior is not well understood[2-4].

Objective: We proposed to identify major barriers to lactation and breastfeeding related to SCI, specifically comparing cervical (C1-C7), upper thoracic (T1-T6) and low-level (T7 & below) SCI.

Method: We conducted a retrospective cross-sectional survey utilising online questionnaires completed by 102 women from Canada, Sweden, USA, Australia, and Denmark with SCI who chose to breastfeed.

Results: High-level SCI was associated with insufficient milk production (p=0.001), absent let-down reflex (p<0.001) and incidence of AD (p=0.002). The most severe complications were absence of the let-down reflex (cervical SCI) and insufficient milk production (upper thoracic and low-level SCI). Autonomic Dysreflexia (AD) was triggered by breastfeeding in 24% of women and more prevalent with higher SCI (cervical: 46.7%; upper thoracic: 25.0%, low-level: 13.1%). Women with low-level SIC were 2.61 times more likely to breastfeed for >6 months (as per World Health Organization recommendations) compared to cervical SCI. The top reasons for breastfeeding cessation were time needed for activities of daily living (cervical & upper thoracic SCI) and sleep loss (low-level SCI). Self-reported postpartum depression was 4 times more prevalent than clinical diagnosis, indicating potential underdiagnosis.

Conclusion: Women with SCI at or above T6 have shorter breastfeeding duration, likely due to disruption of the neurohormonal signaling that is crucial for milk production and ejection. When managing women with SCI who choose to breastfeed, clinicians must consider numerous factors including AD, sleep deprivation and depression.

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When to Treat Spasticity post Spinal Cord Injury

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Spasticity is a common complication resulting from the damage of the upper motor neurons in the central nervous system. It is a highly prevalent secondary consequence of the spinal cord injury (up to 65% at community discharge) and it is problematic in one third of all patients with SCI up to 5 years post injury (35%)[1]. The term problematic spasticity includes all the possible problems resulting from spasticity and require antispasticity pharmacological treatment or interventions. These problems might be considered objective, subjective or both. Functional problems are the result of the interference of discomfort and stiffness, pain, spasms, contractures and skin breakdown with activities of daily living like transferring, walking, personal hygiene, washing, dressing, sexual activity etc. The results of spasticity also affect perception of self and self image, cosmesis, emotion, mood and motivation. For those reasons problematic spasticity worsens quality of life and interferes with employment, socialization, volunteering and recreation activities.

There are several specific characteristics of spasticity of spinal origin with personal variations and alterations in time which need close community follow up[2]. The beneficial effects of spasticity may interfere with the negative effects making therapeutic decisions difficult. The treatment plan changes according to the degree and location of the problematic spasticity. The effects of spasticity in each patient (objective and subjective) need assessment, patient update and consultation as well as goal planning. There are measurements helping us to quantify and specify spasticity like Modified Asworth Scale, Functional Independence Measure (FIM), Penn Spasm Frequency Scale, Spinal Cord Injury Spasticity Evaluation Tool (SCISET), Patient Reported Impact of Spasticity Measure (PRISM) and Spinal Cord Injury Health Questionnaire[3]. The decision to treat spasticity is individualized, functional oriented and a combination of less invasive and cost-efficient treatments is the first step for achieving the most successful outcome.

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The Use of Botulinum Toxin in Spinal Cord Injury: Special Considerations

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Botulinum toxin A (BTX-A) is an important therapeutic method in the treatment of focal and regional spasticity. According to the international literature, 78% of the individuals with SCI, will develop a grade of spasticity one-year post-injury. Taking into account the severity of the lesion, according to AIS, 93% of patients with cervical injury diagnosed as AIS A and 78% diagnosed as AIS B-D will present spasticity[1,2]. The BTX-A is the first-choice intervention for focal spasticity and less in generalized which is common in SCI[3].

Special considerations of the use of BTX-A in SCI: Planning the intervention with BTX-A, the therapeutic goals setting is different in complete or incomplete SCI, and if this intervention is combined with another treatment[4]. In patients with incomplete lesions either are under antispastic management per os or intrathecally or not, the injection of BTX-A in selected muscle groups could be effective in amelioration of functionality of the upper limb, walking ability, use of orthosis, intermitted bladder catheterizations (CIC). In complete lesions the goals are oriented in amelioration of the nursing care, positioning, hygiene, CIC[5].

Pain due to spasticity in patients with incomplete SCI is significantly reduced after BTX-A injection, according to the literature an amount of 55% of the patients undergone an BTX-A intervention reported pain relief greater than 20% 4 weeks post injection[6].

The intravesical injection of BTX-A in patients with urinary incontinence due to detrusor overactivity, who does not respond well to per os medication, reduces incontinence episodes, ameliorates urodynamic parameters and reduces episodes of autonomic dysreflexia, up to 9-10 months post-injection[7]. Also, the BTX-A injection into the external urethral sphincter may ameliorates the potential of voluntary voiding in patients with incomplete lesions or facilitates the catheter passing in cases that a-blockers and p.o. antispastic agents are not sufficient[8].

In conclusion, the use of the BTX-A contributes to the improvement of health-related quality of life of persons with SCI[9].

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Neurosurgical Trends for Cerebral Revascularization to Treat Arterial Steno-occlusion: Indications, Clinical Features, Surgical Treatment and Outcomes

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Symptomatic anterior cerebral arterial steno-occlusion is often associated with neurofunctional deficits, high risk of recurrent stroke or both. 70% of overall ischemic strokes are caused by anterior circulation arterial stenosis or occlusion. Although both medical and endovascular treatments are useful and suitable, there is a place for indirect encephaloduroarteriosynangiosis (EDAS) bypass in patients with brain steno-occlusive ischemic disease. In our recent practice, encephaloduroarteriosynangiosis (EDAS), a relatively easy to perform procedure, has been shown to be beneficial in adult patients with ischemic disease symptoms[1,2].

During surgical procedure, protection of the middle meningeal artery (MMA) and superficial temporal artery (STA) is very important, and close attention is warranted while the dura mater is open to spare the MMA branches to the greatest extent possible. Systolic blood pressure is strictly controlled in the range of 120-140 mm Hg to avoid hypotension throughout the procedure/surgery. Hyperventilation is avoided to prevent vasoconstriction caused by hypocapnia. All patients receive aspirin (100 mg daily) during the perioperative period.

Currently, patients with non-moyamoya anterior circulation arterial steno-occlusion require optimal treatment strategies to significantly reduce the risk of stroke and improve nervous system function after infarction. Indirect revascularization may be a safe and effective surgical technique for improving blood flow to the ischemic areas induced by non-moyamoya anterior circulation arterial steno-occlusion, especially in patients with residual neurologic deficits after infarction. Our study results demonstrate that successful EDAS surgery, with visible neovascularization of the underlying brain from the STA and MMA, appears to correlate with improvements in ischemic symptoms.

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Microsurgical Lesioning Techniques for Spasticity

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Spasticity is a common sequelar condition frequently encountered after a variety of pathologies that affect the upper motor neuron system. As a component of the upper motor neuron syndrome, spasticity is a frequently encountered clinical condition. In the strict

sense, spasticity is defined as the hyperexcitability of the stretch reflex related to the loss of inhibitory influences from descending supraspinal structures. Spasticity may be either useful - by compensating decrease in motor strength - or harmful - by limiting both passive and active motion and, in the extreme, by leading to irreducible contractures and deformities - or as in most cases and harmful and useful in the same patient.

When spasticity fails to be controlled by relaxant medications and physical therapy and special rehabilitation programs, functional neurosurgery can be recourse. Spasticity should not be treated just because it is present. Hypertonia may compensate loss of motor power. Spasticity should only be treated when excess of tone leads to further functional losses, impairs locomotion and motricity, or induces deformities.

Differentiation between the harmful component(s) of spasticity and its useful contribution in the antigravity postures and locomotion may not be easy to achieve, the more so as one and the same muscular group may be able to simultaneously produce useful and harmful effects. Meticulous clinical and gait analysis, if necessary with anesthetic blocks, are most helpful in the selection process.

Then the various treatment modalities are described with respect to their impact, whether general or focal, and their effect, whether temporary or permanent. The neurosurgical armamentarium includes: pharmacological therapy with Intrathecal Baclofen and Lesioning techniques with Botulinum toxin injections, Surgery to the Peripheral Nerves, the Dorsal Root Entry Zone to spinal cord and the Dorsal Roots[1,2].

Lesioning operations are reserved for severe spasticity in the limbs if treatment with botulinum toxin injections has become insufficient. Peripheral neurotomies are preferred when harmful spasticity affects one (or a few) muscular group(s). An anesthetic block used as a preliminary test may help predict the outcome by mimicking the effect of a planned neurotomy. When harmful spasticity affects the entire limb(s) in paraplegic or hemiplegic patients, surgery directed to the dorsal root entry zone (using lumbosacral or cervical microsurgical DREZotomy) may be the solution. Peripheral neurotomies (PN) are recently reactivated thanks to microtechniques and electrophysiological mapping. PN are indicated for severe focal spasticity, when botulinum toxin injections become less effective and cannot delay surgery any longer. PN aim at rebalancing the tonicity of agonist and antagonist muscular groups by reducing excessive spasticity. Surgery in the dorsal root entry zone (DREZ) in the spinal cord was oriented to treat some types of topographically limited neuropathic pain[3]. Because of its inhibitory side-effects on muscular tone, namely, the induction of marked hypotonia, the method was applied to patients with severe focalized hyperspasticity.

Whatever the final decision, all steps of the program should be conceived, discussed, and applied within the frame of a multidisciplinary team.

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International Standards for Autonomic Function after Spinal Cord Injury (ISAFSCI), Conus Medullaris Reflexes

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The consequences of spinal cord injury (SCI) may influence all systems of the body whose function is affected to varying degrees. The severity of the lesion and the functional status after SCI were determined for a number of years with the Frankel scale (1969). Comparison between different approaches of management, final outcome and therapeutic efficacy requires common language and terminology. Knowing the great importance of the severity of lesion concerning the planning of the rehabilitation program and the possible future candidacy of individuals with SCI to new therapeutic techniques, the severity of autonomic nervous system (ANS) dysfunction should be a significant part of SCI evaluation.

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) as a result of the collaboration of two large scientific organizations (ASIA & ISCoS)[1] is being revised and updated (8th edition, 2019) in an attempt to reduce ambiguity in the method of clinical evaluation and reporting of this evaluation. The ISNCSCI refer to residual somatic nervous system function and cannot be used to document the degree of ANS function after SCI. In May 2004, ASIA appointed a working group with international participants to develop standards for ANS function after SCI. A steering committee, and subgroups to discuss bladder, bowel, sexual and general autonomic functions were appointed. The International Standards for Autonomic Function after Spinal Cord Injury (ISAFSCI), by ASIA and ISCoS were presented. Internationally accepted definitions of ANS dysfunction in accordance with the level and severity of the SCI are lacking. Bedside examination is not always enough to document cardiovascular, bladder, bowel and sexual function after SCI; for example, special clinical tests are needed to study cardiovascular function of individuals with SCI, urodynamics to evaluate voiding, etc. The ISNCSCI is based on physical evaluation, the ISAFSCI takes into account self-reported history as well and both can be performed at acute phase and during follow-up[2].

The ISAFSCI is under revisions targeting the clarification of history report, clinical assessment with standardized tests and finally the establishment of a validated autonomic classification tool for individuals with SCI[3,4]. The initially included Urodynamics evaluation is no more a component of the form. However, the Autonomic Standards Committee encourages clinicians to consult the International Urodynamics SCI Data Set.

The ISAFSCI is still a relatively novel tool and only a limited number of clinicians use it on a regular basis. Somato-somatic and visceral-somatic conus medullaris reflexes involving neurotomes T12 to S5: anal, vesico-anal, vesico-urethral, and anal-cough reflexes[5], bulbocavernosus, and dardos reflexes[5-7], may contribute to clarify the severity and prognosis of SCI despite the opposing views in the literature[6,8,9]. For lesions above T11, testing for pressure sensibility over the S3 dermatome and voluntary hip adductor and toe flexor muscle contraction provide similar information with deep anal pressure and voluntary anal contraction respectively[10].

In conclusion, future revisions of ISAFSCI with clarifications needed and the incorporation of some conus medullaris reflexes may contribute to a more accurate evaluation and prognosis for SCI in conjunction with ISNCSCI.

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Acute Spinal Cord Injury: Decisions on Management - Predictors of Recovery. The Importance of Proper Timing

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Acute traumatic spinal cord injuries (SCI) have multiple and complex consequences requiring the expertise of a well-trained and well-coordinated multidisciplinary team. The appropriate management especially during the transitional period between spinal shock and recovery of reflexes seems to be fundamental to prevent catastrophic secondary events.

There was a general belief that surgery was beneficial to neurological outcome, to achieve early mobilization, reduce complications of recumbency, and shorten hospitalization time. However, there is no evidence to suggest that surgical stabilization enhances the speed of healing or achieves stability earlier than conservative management[1]. In contrary, conservative control of both the physiological instability of various systems including the spinal cord as well as of the biomechanical instability of the spinal column will result in better recovery without direct intervention on the spine or neural tissues[2]. Therefore, progressive neurological deterioration in the presence of cord compression and pure ligamentous injuries with dislocation are the only absolute indications for surgery[3].

An accurate and on time estimation of neurological recovery is crucial for setting goals and organizing rehabilitation programs. The International Standards for Neurological Classification of SCI (INCSCI) and the Magnetic Resonance Imaging (MRI) are the more consistent predictors of recovery. The INCSCI is a well-established examination tool used to determine the level and severity of injury[4]. Seventy-two hours after SCI considered the most reliable period to provide positive and negative prognostic signs[5]. Within the first three months, the vast majority of incomplete injuries will show some motor recovery below the initial injury level[6].

The use of MRI after acute SCI has significantly increased not only for its diagnostic role but also for giving prognosis[7]. Sagittal T2 sequences can identify and measure the extent of both edema and hemorrhage within the spinal cord and also appear to give more reliable prognosis 72 hours after injury[8].

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Spinal Cord Injury and the Impact of Associated Traumatic Brain Injury: the Neurosurgery Aspect

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SCI is a complex condition associated with substantial disability, reduction in quality of life, and costs. A significant proportion (up to 74%) of patients with spinal cord injury (SCI) have concomitant traumatic brain injury (TBI) of varying severity, and the combination often produces difficulties in planning and implementing an adequate management strategy. The acute, surgical or medical, treatment as well as rehabilitation strategies and more delayed reconstructive neurosurgery interventions, are all influenced. SCI with TBI (or worse, with polytrauma) poses uniquely challenging considerations due to the increased risk of secondary insults to the spinal cord.

Many questions arise and evidence levels are not very high. Where does treatment begin? Where these patients should be managed? Which injury to treat first? What is the appropriate time of intervention? What type of surgical procedure is the most appropriate? What about medical therapies? When does rehab kick in?

Unfortunately, a widely accepted neuroprotective strategy or algorithm for SCI, let alone concurrent SCI/TBI, does not exist. A large emphasis has now been placed on the concept of 'time is spine' where early, streamlined interventions in the immediate post-injury phase are essential for improving long-term outcomes, and there is growing evidence that early decompression provides improved functional outcomes[1]. However, in the setting of associated brain injury, neuroprotection for the brain may be also required which could interfere with timing or use of spinal cord neuroprotective measures.

In the setting of neurotrauma, treatments are being constantly re-examined[2,3]. Multiple promising therapies are actively being explored along the basic science and translational research pipeline. Pharmacologic treatments, cell-based therapies, and other technology-driven interventions, will likely play a combinatorial role in the evolving management of neurotrauma, along with reconstructive neurosurgery interventions. A truly effective neuroprotective therapy in neurotrauma remains, however, elusive and large multicenter trials are warranted.

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Spinal Cord Injury and the Impact of Associated Traumatic Brain Injury: the Physical & Rehabilitation Aspect

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A significant proportion of traumatic burden of the worldwide population consists of traumatic brain injury (TBI) and spinal cord injury (SCI)[1]. Up to 72% of SCI patients have a concomitant TBI[2] while 12% of TBI ones have been found with a concomitant SCI[3]. Risk factors for double diagnosis (DD) in SCI derive from their common etiology, i.e. motor vehicle accidents, alcohol intoxication, as well as lower force injuries as falls[4]. The SCI level though not so important could be a criterion as far as the cervical level is concerned[5], while the most often overlooked cases of DD are the ones caused by lower forces as well as sub-cervical injuries[6]. The pathophysiology is common potentially leading to dysautonomia, heterotopic ossification, spasticity, endocrinologic disturbances being met in both conditions[2]. A missed TBI diagnosis might mislead to the perception of noncompliance, inability to learn, maladaptive reactions to SCI and poor motivation, masking the underlying cognitive dysfunction[7]. Dealing with the cost of care of DD, this seems increased compared to single SCI, the length of stay can be longer requiring more nursing resources and their level of function is lower at discharge, with greater difficulty in sequential functional activities and community reintegration[8]. The increased level of suspicion for a cooccurring TBI in SCI seems justified[9] while in parallel every patient with SCI should be examined and addressed for cognitive impairments[10].

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The Experience of Orgasm in Individuals With and Without Spinal Cord Injury

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Orgasm is a special physical and psychological state, the final stage of sexual arousal. It is a multidimensional issue and depends on the experiences, the psychological state of the two partners at the time, as well as the character of each of them. A common feature of human orgasm is the ejaculation for men and women, the contraction of the internal genitalia muscles, so as to assist in sperm retention and fertilization, as well as a large amount of fluid, also known as female ejaculation. Sexual function is controlled by parts of the central nervous system (brain and spinal cord). Interruption to the nervous system due to injury of the spinal cord will affect sexual function which depends on a variety of factors: injury level, severity of damage, gender. Despite the fact that the erotic mood in the paraplegic remains unchanged, their sexual activity is clearly reduced. The consequences of SCI: sensory loss, muscle stimulation, erection - ejaculation - lubrication disorders, paralysis of muscles, loss of hand function below the lesion and probable hypersensitivity (para-orgasm) above the lesion. Complications of SCI: spasticity, motor loss, urinary incontinence, swelling, fatigue, pain, body-image change, self-esteem reduction, limited participation. Maintaining a healthy sex life after spinal cord injury remains an important priority. Restoration of sexual health following spinal cord injury is very important and requires not only the treatment of erectile dysfunction, but also the restoration of "orgasm" and above all the happiness of couples and families. An integrated approach to the problem must take place within the rehabilitation team in order to deal with sexual dysfunction and to resolve arising problems with expertise and knowledge, leading to a more satisfying sex life.

When to Start and when to Stop Consultation on Sexual Health post Spinal Cord Injury

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Sexuality is often one of the first concerns for people who sustain a spinal cord injury (SCI)[1]. Early after injury, people with SCI often ask questions about their attractiveness, relationships, and ability to conceive and possibly have children. In the first months following a spinal cord injury, it is natural for individuals to be focused on physical recovery and rehabilitation. However, coming to terms with sexuality after spinal cord injury is an important step toward making a healthy adjustment. As a result, many clinicians understand the importance of discussing these issues. However, there has been little agreement as to when, how, and who should be answering questions related to sexuality and reproduction[2].

It is important for people with SCI and their partners to be given the opportunity to have an open dialogue regarding sexuality with their health-care providers[3,4]. The goals of sexuality consultation after injury are to provide basic information about what changes to expect related to SCI and to broaden the client's concept of satisfying sexual experiences[1]. Sexuality consultation should provide sexual information and specific suggestions to the client in order for him or her to become "sexually abled" and to feel good about sexuality. After receiving adequate sexuality education, clients should understand the impact their injury has on their sexual response and how this can inhibit desire and response. They should also be able to identify ways to compensate for the changes in function and to tell a partner what feels good and where[5].

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Special Considerations of Child Care for Parents with Spinal Cord Injury

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Spinal Cord Injury is a medically complicated situation which substantially disrupts the quality of life of the person who experiences it[1,2]. However, nowadays in high-income countries, SCI can be regarded less as the end of a productive life and more as a personal and social challenge which can be successfully overcome[2].

Individuals with SCI are at risk of various secondary conditions, which can be the cause of morbidity and mortality. Although some of them occur at the pre-hospital and acute care stages after the injury, others can occur at any stage[1]. Proper medical care and rehabilitation can prevent the complications which are combined with SCI and help the patient have a full and productive life fulfilling roles in as many areas of occupation as possible (activities of daily living, leisure time, education, play, social interaction)[1-3].

One of the main goals in the rehabilitation of individuals with SCI is the attainment of the maximum degree of their independence in the activities of daily living (feeding, dressing, toileting, personal hygiene and grooming, sexuality, household chores, care of others, etc.)[2]. Parenting is a matter of great concern for individuals with SCI and especially women, because they either want to have a baby or they already have one and need to take care of them without meaning of course that it is not of concern for male parents with SCI as well. Bibliography on the subject is limited and many a time the information is lacking or non-existent. Recent research has shown that parenting for parents with SCI presents a difficult challenge due to physical limitations, lack of aids, proper equipment and access to playgrounds, stores and streets[1,3-5].

Occupational Therapy plays a significant part in preparing an individual with SCI for parenting[5]. The occupational therapist informs the individual of the changes required in the environment where the child will be raised (ergonomics in space, furniture adjustment). They also suggest the purchase of proper equipment, as well as the adjustment of objects for breastfeeding, bathing, dressing, hygiene, play, the transport of the baby by the parent with SCI[2-7]. Finally, the goal of Occupational Therapy is to provide ideas and strategies in order to find effective solutions regarding child care for parents with SCI with the use of equipment and proper handling[2,5].

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The Importance of Early Diagnosis of the Overuse Syndromes' Risk of the Upper Limbs of Persons with Spinal Cord Injury

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The life expectancy of people with spinal cord injury has improved dramatically in recent decades, almost equal to that of the general population. At the same time many problems arise from the upper extremities and affect the areas of the shoulder, wrist and elbow[1]. In particular, pain in the upper extremities is a very common symptom and affects 30% to 70% of patients with spinal cord injury. Most commonly it occurs in the shoulder, 75% are estimated to have shoulder pain throughout their lives with the rate increasing as the number of years after the injury. The following is the area of the wrist and elbow.

Diseases of the soft tissue (tendinopathy, capsulitis, rotator cuff tears), impingement syndrome, myofascial pain syndrome, osteoarthritis and pressure of the median nerve on the wrist appear to be the most common causes.

Contradictory results have emerged in recent years in international literature, possibly due to the influence of social and cultural factors that influence patients' independence/dependence. The occurrence of pain in the upper extremities seems to be related to many parameters such as age, gender, duration of injury, level and completeness of injury, wheelchair use.

Persons with higher level injuries were more likely to report upper extremity pain than were persons with paraplegic injuries[5]. For many of these individuals, the pain is severe and accompanied by reduced physical functioning and lower quality of life.

For all the above reasons, it is well understood that early prevention of upper extremity diseases caused by overuse due to the high requirements for the mobility and self-care of people with spinal cord injury is vital.

To achieve the desired results, we must evaluate our patients and proceed to a series of interventions[2,3]. Programs including stretching, strengthening and cardiovascular exercises have been proposed. Shoulder and back muscles must be strong enough to support transferring and wheeling. Minimize the frequency of repetitive upper limb tasks and the forces required to complete them is another important intervention. The patients must learn also to avoid the extreme internal rotation and abduction of the shoulder, avoiding putting the hand above the shoulder and avoiding also extreme positions of the wrist.

Evaluation of transfer and wheelchair propulsion techniques[4]: hands as close to the body, less number of daily transfers, slide boards or lifts, ideal weight of the person, possibility of using a power wheelchair, light model of a manual wheelchair, seat in the right position, good stability, avoid the wheeling through grass, sand or heavy carpeting.

In conclusion, very important is the role of all health professionals who should inform patients with SCI about the likelihood of injury and pain in the upper extremities, the importance of prevention, treatment options and the need to remain in a good fitness[1,5].

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Management of Osteoporosis Post Spinal Cord Injury, Acute Phase

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A reduction in bone mass is observed in subjects with spinal cord injury (SCI). Therefore, fractures are happening in paralyzed limbs of SCI subjects[1,2].

However, the pattern of bone loss differs from other metabolic bone diseases or disuse osteoporosis. There is no demineralization in supralesional areas following SCI. Moreover, given the pathophysiology of the spinal cord injury with concomitant hypercalciuria etc. in acute phase, there is no excuse not to prevent these subjects from bone loss[2]. Basic therapy includes the administration of calcium. A total calcium intake of 1000 mg daily is recommended, but the conventional diet is generally considered insufficient. In acute SCI, calcium dietary intake is beneficial because the suppression of PTH results in reduced absorption of calcium in gut. Before starting therapy with antiresorptive drugs supplementation with vitamin D is necessary. Basic therapy includes the administration of vitamin D3 and recommended dose should be 800 - 1000 IU per day.

Twenty-five years ago, mainly hormone replacement therapy and calcitonin, were available for the treatment of osteoporosis. In recent years, the therapy of bone loss, outside of the field of spinal cord injury medicine, has been developed significantly with the use of antiosteoporotic therapies with anti-resorptive and anabolic drugs based on well-conducted trials with fracture as endpoints, which reduce effectively the risk of spine, hip fractures and non-vertebral fractures by up to 70%, 40-50% by over 50%, respectively[3]. Another countermeasure except neutraceuticals and drugs in the early phase is early mobilization (i.e. Tilt Table / Standing).

There is a need to obtain better evidence for the recommendations on diagnosis, prevention and treatment of bone loss in SCI because of lack of meaningful long-term studies. This result that the antiosteoporotic prophylaxis and therapy in SCI may possibly be carried out only "off-label".

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Management of Osteoporosis Following Spinal Cord Injury in the Chronic Phase

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Spinal cord injury is followed by a sudden loss of muscle function and weight-bearing together with many other dramatic changes in body functions. The sudden loss of mechanical loading combined with other autoimmune, neural, vascular, hormonal, nutritional changes affect bone mass and architecture leading to a significant decline in bone mineral density below the level of the injury[1]. Sublesional osteoporosis (SLOP) is characterized by a significant decline in hip and knee bone mass following the injury and is associated with a lifetime increased bone fragility and fracture risk. A higher incidence of fragility fractures is recorded among SCI people (25-46% of persons with chronic SCI) with the majority of them involving the distal femur and proximal tibia (knee region This is consistent with the bone density decreases in this area. The risk increases for women, completeness of injury, longer duration and use of pharmacologic agents as heparin and benzodiazepines. Other risk factors further affect the bone health. Bone Mineral Density in hip and knee region can decrease to 25-50% below that of able-bodied peers during the first 1-1,5 years postinjury. Risk factor profile and clinical history help identify individuals with chronic SCI and increased fracture risk,

which is further measured and monitored with hip and knee region BMD. Biomarkers provide further information about the metabolic activity of the bone.

So far there is no consensus among clinicians either about the prevention and investigation or about the treatment guidelines for the acute or the chronic phase[3]. The primary purpose of this article is to raise awareness about the need for SLOP investigation and management as well as to stress the need for further research in this area.

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Robotic and Virtual Reality: Their Contribution to Functional Rehabilitation after Spinal Cord Injury

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Medical Rehabilitation is connected with the evolution of technology, as it has a significant contribution to the development of specialty. Proper use of technology is therefore a challenge in the day-to-day rehabilitation management. For SCI patients, technological support includes robotic assisted and virtual reality training[1-4]. The objective in robotic assisted training is to provide substantial support to the patient's active effort, indicating that this action is important in cases of incomplete SCI. The systems used (exoskeleton) mainly refer to the enhancement of the gait mechanism, with allowing adjustments according to patient's involvement. This supported by serious scientific data and applied with various robotic systems. Virtual reality is an artificial environment, essentially a computer program whose main purpose is to persuade the patient and accept it as real and education in VR environment, has been based on the neurophysiological mechanisms related to motor learning. The VR transmitted to the patient audio visually through a screen or glasses and is operated either with a keyboard or with special gloves or sensors, creating interaction between patient and program[5-8]. It is used either to diagnose and assess the severity of the impairment or to manage it. Requirements for applying VR are patient involvement and immersion in the environment used. This active process requires the patient's attention and understanding of the instructions and of course their execution. Immersion ensures the operation within the environment we offer. With these processes we provide appropriate motivation, necessary training support for better muscle coordination and movement mechanics, adequacy and precision of the movement and low energy costs, while at the same time seeking to correct mechanism and pattern of motion. Evaluate and treat function, this is why it is great to be physiatrist: you may not always help motion, but you can always address function, participation and having a role.

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Classification of Pain Post Spinal Cord Injury

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Traumatic spinal cord injury (SCI) is associated with severe impairments including motor/sensory loss and bowel/bladder dysfunction. However, acute and chronic pain have been identified as the most challenging SCI-associated medical conditions. Before 2011, 3 taxonomy systems for post SCI pain had been established as the main systems. These tools included the Cardenas taxonomy[1], the classification of the International Association for the Study of Pain[2], and the Bryce-Ragnarsson taxonomy[3]. In 2011, a unified system - the International Spinal Cord Injury Pain Classification (ISCIP) - was created and since then it has been adopted by a large number of scientific SCI and pain associations[4]. The main distinction of this system divides pain into nociceptive pain, neuropathic pain, other pain, and unknown categories. Nociceptive pain is further divided into musculoskeletal pain, visceral pain, and other nociceptive pain, whereas neuropathic pain is further divided into at-level pain, below level pain, and other neuropathic pain. The relatively low reliability levels (65-85%) of this tool highlights the difficulties in assessing and categorizing SCI-related pain[5]. Spasticity and sensory loss - especially in patients with complete lesions - are also factors that intervene with pain pathways and mechanisms, making post SCI pain taxonomy even more complex[6,7].

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Pain After Spinal Cord Injury-Conservative Treatment

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Pain is a common problem for people with spinal cord injuries (SCI) and has a negative impact on quality of life. Pain after SCI can occur in parts of the body with normal sensation as well as in areas that have little or no sensation. Understanding what type of pain, you have is the key to choose the right treatment. Pain can be neuropathic, musculoskeletal or visceral[1]. In order to treat all these different causes that produce pain a physician may choose a combination of drugs, therapies and other treatments, including psychological treatments[2].

Physical therapy with physical modalities like TENS, stretching with range of motion exercises and therapeutic massage reduce musculoskeletal pain. Acupuncture is a method followed by many physicians to treat musculoskeletal pain as well.

Relaxation techniques are many times recommended by psychologists to reduce muscle pain tension in a manner of self-management.

Medications are a common option in pain management and many times combinations of drugs work better than a single drug. Non-steroid anti-inflammatory drugs, anti-seizures such as Gabapentin and Pregabalin, anti-depressants, narcotics, muscle relaxants and anti-spasticity drugs are the drug categories that are used to treat pain. The medications should be recommended and prescribed by a physician since they may have side effects.

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Surgical Management of Chronic Pain Associated with Spinal Cord Injury

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Patients with spinal cord injury (SCI) are commonly complicated with chronic pain either nociceptive or neuropathic type. The mechanism is often poorly understood, and it is further complicated by the psychosocial impact of the injury. The available surgical treatment options do not work in isolation and need to be combined with pharmacological agents, physical and psychological therapy. Surgical interventions can be classified by what they aim to treat (nociceptive, neuropathic pain or combination of them).

Surgical treatment is commonly required in compression neuropathies (carpal tunnel syndrome, ulnar nerve entrapment, thoracic outlet syndrome, pudendal neuropathy), in syringomyelia formation and in the presence of segmental pain at the level of injury. Steroid injections, radiofrequency ablation techniques, dorsal root entry zone (DREZ) lesioning and surgical decompression can provide an adequate relief from pain. To a large portion of patients with neuropathic pain, the application of neurostimulation techniques may give satisfactory results. The noninvasive neurostimulation therapies currently available are transcutaneous electrical nerve stimulation, repetitive transcranial magnetic stimulation and transcranial direct current stimulation. Minimally invasive neurostimulation techniques are spinal cord and peripheral nerve stimulation, nerve root stimulation, deep brain and motor cortex stimulation.

A multidisciplinary approach is recommended in the treatment of all patients with pain after SCI, based on a teamwork of pain and rehabilitation therapists and focused on improving patients' quality of life.

The Electrodiagnostic Approach of the Spinal Cord Injury

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When muscle weakness happens, we have to indentify the location of the problem in the motor pathways: cerebral cortex, spinal cord or a site of the motor unit (anterior horns, motor neural root, peripheral nerve, neuromuscular conduction or muscle fiber)[1]. The use of proper electrodiagnostic procedures may offer information for the location of the lesion and the progress of the lesion.

In patients with spinal cord injuries multiple neural elements such as ascending and descending pathways, spinal neurons, roots, plexus and peripheral nerves may be involved. Factors like pain, spasticity, muscle atrophy, sprouting and affected consciousness level arouse difficulties in physical examination. The electrodiagnostic tests, as a supplement tool, confirm and quantify the findings of a detailed physical examination and imaging findings providing some special and unique information[2].

We use electrodiagnostic tests[3] to understand the pathophysiology of the lesion, to predict the outcome[4], to monitor and adapt the rehabilitation procedure, to diagnose secondary neural complications, to estimate spasticity or other muscle tone disorders[5].

The electrodiagnostic tests we use in a spinal cord injury for qualitive and quantitative information are: compound muscle action potential[6], M-response, sensory nerve action potential (SNAP)[7], cortical motor evoked potential (MEP), recruitment rate of motor units and delayed responses[7] (H-reflex, F-wave). Tests with small or unproven usefulness are the needle EMG, the stability of muscle membrane test, the somatosensory evoked potential (SEP)[8,9] and number of motor units.

It is essential the time[4] of applying electrodiagnostic tests after a spinal cord injury, because every parameter we examine has a different expression (appearance, disappearance, ascending, descending) in relation with the time.

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Preventive Management of Autonomic Dysreflexia

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Autonomic dysreflexia (AD), is a condition that emerges from a traumatic spinal cord injury at or above the sixth thoracic segment. It reflects an episodic hypertension and concomitant baroreflex-mediated bradycardia initiated by unmodulated sympathetic reflexes in the decentralized cord. The prevalence of AD increases according to the level and severity of SCI reaching the 90% of cases[1,2].

Since the most common stimuli originate within the urogenital system[3], proper bladder and bowel management (i.e., regular bowel program preventing fecal impaction, indwelling or intermittent catheterization preventing bladder distention) and a regular follow-up are mainstays in preventing episodes of AD.

Use of botulinum toxin for chemodenervation of the bladder has also been shown to reduce autonomic dysreflexia in susceptible individuals[4]. Pharmacological agents such as minocycline has been shown to have promising neuroprotective effect in AD[5].

Management of aggravating parameters such as pressure ulcers, hemorrhoids, ingrown toenails, tight or restrictive clothing is highly recommended. Protective measures for deep vein thrombosis and control of menstrual pain have also been suggested, while 2% lidocaine intravesical administration prior to routine Foley catheter changes has been shown to reduce AD significantly in patients at high risk[6].

In conclusion, patients with spinal cord injury and their caregivers should be educated to recognize the early symptoms of AD and understand the common causes and management. Apart from prevention, quick recognition and rapid alleviation of the underlying stimulus constitute the pearls of AD management. If not treated timely and properly, cardiovascular and systemic consequences may be deleterious.

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Spasticity as a Secondary Condition post Spinal Cord Injury and as a Symptom

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Spasticity is defined as a velocity dependent increase in muscle tone and can cause involuntary muscle contractions, muscle spasms, stiff or tight muscles, clonus and pain. Stiffness impact is highly correlated with the Patient Reported Impact of Spasticity Measure (PRISM) negative impact on Daily Activities subscale and moderately correlated with the other PRISM subscales[1]. Evidence that relate physiological indices to individual perception of spasticity, via the recording of involuntary EMG during transfer from wheelchair to bed, suggest that spasm frequency is indicative of spasm severity. High spasm frequency and painful spasms alone were associated with interference with function[2]. Sudden or unexplained changes in spasticity can signal a health problem that needs attention. Patients with urologic complications will not describe classic symptoms but a change in their neuropathic pain and spasticity patterns. Gastrointestinal problems may present with general malaise, anorexia, nausea or increased spasticity below the level of the injury. Musculoskeletal problems may appear with increased spasticity in a limb and a general sense of malaise. Patients may not have any sensation of having sustained a fracture. Pressure injuries are a major cause of increased spasticity. Baclofen withdrawal presents with increased tone, fevers, mental status changes, hallucinations, paranoia and tachycardia[3]. Charcot spinal arthropathy can appear as an unusual back protuberance, decreased spasticity and change in bladder function[4]. On the other hand, spasticity helps maintain skeletal muscle mass[5], improves circulation and reduces swelling. It is helpful in regular daily activities such as supporting the body weight while transferring, standing and walking. Intentionally triggered spasms can help to empty the bowel and bladder in people with specific types of bowel or bladder dysfunction. Spasticity and reflex erections interfere during sexual activity. So, it is essential that management targets function and is always patient focused rather than aimed at reducing the degree of spasticity[6].

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Pain Management in Patients with Spinal Cord Injury

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Pain is a common problem in spinal cord injury (SCI) patients. It can either occur as a direct or as an indirect consequence of SCI. It impacts about 65%[1] of patients with one-third of these, experiencing severely intense pain impacting on mood, functioning, and quality of life. The pain can be nociceptive (including visceral pain), neuropathic, or other (nociplastic, algopathic etc.). Nociceptive pain can be due to the initial trauma, muscle and joint overuse and injury-related muscle weakness, spasm, and contractures. Neuropathic pain can present at or below the level of injury, arises from damage to the nervous system itself, central or peripheral, either from disease, injury, or pinching[2]. Other types of pain as the newly introduced nociplastic pain relate to altered nociception[3]. There are also situations that contain elements of more than one pain category and can be classified as "mixed" pain states[4]. Identification of pain subtypes is crucial to determine the appropriate treatment.

Recommended therapies can be single or combined if needed. Therapeutic approaches comprise in pharmacological and non-pharmacological strategies. Pharmacological therapies can include antiepileptic, antidepressant, opioids, cannabinoids, antispastic drugs. Drugs can be administrated by advanced interventional methods such as intrathecal pumps (delivering antispastic or/and opioids directly to SC)[5,6]. More invasive therapies include nerve block injections (epidurals, stellate blocks, lumbar sympathetic blocks, peripheral nerve blocks), dorsal root entry zone ablation treatments, spinal cord stimulation and other. Non-invasive therapies like transcranial stimulation (tDCS, TMS), physical therapy, osteopathy, acupuncture, and transcutaneous electrical nerve stimulation (TENS) could be used. Psychological therapies such as cognitive behavioral therapy, hypnosis and visual imagery may be also helpful in alleviating psychological distress associated with pain[7,8].

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Recurrent Pressure Ulcer, Why?

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Pressure Injuries are one of the most common complications of Spinal Cord Injurie (SCI) in the chronic phase, with a prevalence of 15-30%[1]. In the acute phase they are the 3rd most common complication following UTIs and Autonomic Dysreflexia with an incidence of 41% the 1st year after discharge post SCI[2]. It is a major complication with high treatment cost, increasing morbidity and mortality in SCI population, reducing mobility and participation. Proper staging and treatment are necessary for prompt and full recovery, in order to avoid complications that are costly and devastating to the quality of life of the patient.

After full recovery, there needs to be an assessment of the risk factors for recurrence of the injury. Even though many risk factors have been taken under consideration[3] in international literature there is no consensus on the importance and impact they have on recurrence. A few though seem to be more prominent, defect size and serum albumin levels[4], patient education in the acute and chronic stage of SCI[5] and habits acquired pre and post SCI[6]. Several general behaviors were protective for recurrent pressure ulcers, including lifestyle, exercise, and diet[7].

Most authors agree that a multidisciplinary approach (surgical or non-surgical treatment of the defect, patient education in transfers, lifestyle and everyday behaviors, nutrition etc.) minimizes hospitalization and reduces the risk of recurrence.

In conclusion some risk factors are common in pressure injuries between SCI and non-SCI populations, level and completeness of SCI, independence and mobility are some of the SCI specific risk factors. Data in this area are scarce and more research is needed to form a strategy in the approach and care for pressure injuries specific in the SCI population in order to reduce their development and recurrence.

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Fragility Fractures in Spinal Cord Injury

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Fractures in SCI are a neglected complication. Rates of fractures 1-6% was previously reported but the number is probably underestimated[1]. Others reported a higher frequency of history of fractures in subjects with SCI (34% of patients)[2]. Epidemiological data from USA reported that 14% increases to 28% at 10 years and 39% after 15 years. The incidence increases with age and is higher in complete SCI in paraplegics compared to tetraplegics and in women than men[3].

Fractures occur in the long femur and the proximal end of the tibia[4]. Fractures of the forearms are rare because of bone mass is protected due to use of manual wheelchairs and in subjects with tetraplegia because of their inability to use their forearms to prevent falls and traumas, which thus affects other parts of the body.

In chronic SCI most common cause of fractures was falling from the wheelchair (51%), followed by fractures during transferring like twisting or catching a lower extremity (14%), and catching a lower extremity on a doorframe while operating a wheelchair (6%)[5]. Fractures are also common while turning in bed and transferring from the wheelchair to the car. Incorrect placement of the feet and hip during turning also increases pressure on the leg and causes fractures[6]. Hospitalization is often required most commonly for tibia/fibula fracture (47.5%) followed by the distal femoral metaphysis (20%), the proximal femur (15%) and then less common fractures of the humerus (5%), metatarsals (5%) and phalanges (7.5%)[5].

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Exercise Guidelines after Spinal Cord Injury

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The routine daily activities for a person with paraplegia or tetraplegia have been proved insufficient to maintain a satisfactory level of physical fitness. Wheelchair living due spinal cord injury (SCI) greatly affects the overall activity level with an increased incidence of secondary complications including involuntary isolation, cardiovascular disease, cardiometabolic syndrome, increased bone and collagen catabolism, and diabetes mellitus[1].

Cardiovascular health, as a predictor of disease risk, can be affected by a number of factors including level and severity of injury, degree of physical deconditioning, and extent of autonomic nervous system impairment[2]. The acute response to exercise and the capacity for exercise conditioning are directly related to the level and the severity of the spinal lesion. Complete injuries at or above the mid-thoracic level present reduced heart rate acceleration with work capacity limited by reductions in cardiac output and circulation to the exercising muscles[3]. Persons with complete low paraplegia on the other hand, exhibit reduced exercise capacity and increased heart rate responses which have been associated with circulatory limitations within the paralyzed tissues[4].

There is a good evidence that the incorporation of structured exercise activities can be used to achieve good physiological and psychological adaptation to neurological injury. However, increasing activity levels in individuals with SCI is not without risks. Participation in exercise may lead to episodes of autonomic dysreflexia or post-exercise hypotension, skin breakdown, musculoskeletal injuries, and thermal dysregulation[5-9].

Therefore, the recommendations for intensity, duration and frequency of endurance and strength training in persons with SCI should be gradually adjusted over time, based on level of conditioning, preferably under the guidance of a clinician specialized in SCI management. Individuals with SCI can benefit greatly by participation in exercise activities, but those benefits can be enhanced, and the relative risks may be reduced by implementing and communicating SCI-specific, evidence-based exercise guidelines[10].

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Submitted abstracts

Oral presentations

OC1

Results of Body-Weight-Supported Treadmill Training to Patients with Spinal Cord Injury

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Objectives: The investigation of Body-Weight-Supported Treadmill Training (BWSTT) on Spinal Cord Injured (SCI) patients' biochemical serum indices as well as their psychometric, somatometric, and functional characteristics.

Methods: 26 patients (20 men, 6 women) with SCI (3 AIS A, 3 AIS B, 20 AIS D). (Time Period after Injury (TPI):16.2 months Standard Deviation (SD):13.3) attended 16 sessions of BWSTT with a maximum duration of 45', with speed and body weight support of their own choice, for a six-week period. The 3 AIS A and 3 AIS B patients walked with the use of an Advanced Reciprocating Gait Orthosis (ARGO). For the investigation of the effects of this intervention, WHOQOL-BREF questionnaires, Modified Ashworth Scale, 10-item Modified Barthel Index, WISCI II walking index, ASIA Impairment Scale (AIS), blood tests and DXA scans, were used at 2-time points, before and after the end of the intervention

Results: At the end of the intervention, Ashworth scale showed a reduction ($p>0.05$) of muscles spasticity (Av:-0.5 to-1), compared to the initial measurement. The Barthel index revealed statistically significant ($p<0.005$) improvement of functionality (Av.:+8.7) (Initial Av.Score:56.92,SD:23.17, Final Av.Score:65.58,SD:22.72). The blood tests showed a statistically significant ($p<0.005$) increase in the amount of Osteocalcin (Av.:+4.2ng/ml) (Initial Av.Score:23.13ng/ml,SD:17.56, Final Av.Score:27.35ng/ml,SD:21.87). The WISCI II index showed statistically significant ($p<0.05$) increase in walking ability (Av.:+1.5) (Initial Av.Score:11.11,SD:7.9, Final Av.Score:12.61,SD:7.21). All other measurements showed moderate improvements but not statistically significant.

Conclusions: The BWSTT program for SCI patients improves functional ability and increases blood serum Osteocalcin.

OC2

The Psychosocial Impact of Exoskeleton Training on Spinal Cord Injury Patients in a Rehabilitation Setting

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Objectives: Spinal cord injury (SCI) affects 250,000 - 500,000 people annually[1]. It leads to life-long physical disability and increased risk of secondary complications, (e.g. osteoporosis, cardiovascular diseases). SCI patients report higher levels of depression and distress and lower levels of life satisfaction. Subsequently, SCI has been related to impaired quality of life of those patients[2,3]. The EKSO GT is a wearable bionic exoskeleton that enables individuals with SCI to stand and walk on level surfaces. It is an innovative device that offers the ability to address goals related to upright postural positioning tasks, including ambulation[4,5].

The aim of this study is to assess the psychosocial impact of training with EKSO GT exoskeleton on patients with SCI.

Methods: The research was conducted in "ANIMUS" rehabilitation center in Larissa, Greece. The sample consisted of 6 SCI inpatients, 4 males and 2 females with complete/incomplete paraplegia. Psychosocial variables were assessed by a 30-minute semi-structured interview and two questionnaires (Beck's Depression Inventory and SF-36). All patients were following program of EKSO GT training twice per week.

Results: All patients reported lower levels of depression and anxiety regarding their rehabilitation after started training with ESKO GT exoskeleton. They also reported that exoskeleton training creates higher motivation to engage in their rehabilitation program and improves their self-perception.

Conclusions: Exoskeleton training is a promising therapeutic approach which seems to improve the psychosocial aspect of SCI.

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OC3

A Case Report Favoring the Nonoperative Management of Mild Cervical Spondylotic Myelopathy

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Introduction: Cervical spinal cord dysfunction is commonly caused by Cervical Spondylotic Myelopathy (CSM)[1]. CSM is responsible for various clinical symptoms ranging from sensory to motor impairments that can significantly limit the patients' quality of life[1]. Although surgical treatment is a preferred intervention, its efficacy on the entire spectrum of clinical CSM manifestations remains under question[2]. With the available evidence favoring nonoperative methods for the treatment of mild (but not moderate or severe) CSM symptomatology[3], a turn towards these interventions and a different organization of the clinical decision-making process should be further discussed.

Case Presentation: A male individual diagnosed with Buerger's Disease was chronically experiencing mild locomotor impairments. After a fall incidence, CSM was also diagnosed via MRI. Surgical treatment was suggested. The individual underwent cervical micro-discectomy and intradiscal cages were implanted. After the surgery, the individual's functional level was diminished and he entered an intensive rehabilitation program in which he is still participating. Despite the significant improvements, the locomotor and functional level has not yet reached the pre-surgery levels.

Discussion: A case is presented in which the functional level of

an individual was diminished and has not been restored. Given the mild severity of the pre-surgery impairments, it is hypothesized that earlier CSM diagnosis and recommendation for nonoperative management could have limited the present implications and significantly reduced the cost of hospitalization.

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OC4

Evaluation of Urine Production, Serum Antidiuretic Hormone, and Circadian Water Rhythm in Patients Suffering from Spinal Cord Injury

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Objectives: In patients with spinal cord injury (SCI), especially of the cervical area, it is often observed an increased urine production during the night. Aim of the study was to evaluate the urine production, serum antidiuretic hormone (ADH), and circadian water rhythm in adults with SCI.

Methods: Twenty-six patients with spinal cord injury (19 men - 7 women) and 20 healthy volunteers (14 men - 6 women) evaluated in the present study. The incidence of spinal cord injury was at least three months before evaluation. The patients separated into two subgroups. Group I consisted of 14 patients with SCI above T6 neuromere and Group II of 12 patients with low injury location. Participants performed a 24-hour urine collection. Two blood samples were taken to calculate ADH variation, diuresis rate, and creatinine clearance.

Results: There is no significant difference in day and night urine production between the two groups of patients with SCI. In this study, both patients' groups did not present a normal variation of ADH excretion. SCI patients showed no circadian rhythms in the diuresis rate or the creatinine clearance. In healthy individuals, night urine volume is significantly less than daily production. Urine osmolarity in the group of healthy individuals was significantly higher at night than that of daily samples. Controls without nocturnal polyuria reported a lower nighttime diuresis rate and lowered nighttime clearance of creatinine.

Conclusion: SCI patients demonstrated absent circadian rhythm in ADH production, diuresis rate, and creatinine clearance. Special treatment stratification is necessary to copy with complications related to nocturnal polyuria of SCI patients.

OC5

Spinal Cord Injury and Traumatic Brain Injury - Are the Boundaries between the two Concrete? Case Report

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Introduction: Both spinal cord injury (SCI) and traumatic brain injury (TBI) can be detrimental in several functional aspects[1]. With prevalence 20-74%[2] and commonly overlooked (up to 60%)[3,4], prompt diagnosis is important modifying prognosis, rehabilitation interventions, prevention and complications' treatment[5]. Even common medications used in SCI can influence the disturbed cognitive function in cooccurring TBI[5,7].

Case presentation: Two common cases will be described.
A female patient, age 29, after a motor vehicle accident, had loss of consciousness for an hour and subsequent GCS 15/15, no post traumatic amnesia and complete T5 paraplegia. At PRM admission, she had non-significant cognitive impairments, mild hypertonia in her lower limbs, no balance seated, being on anticoagulant and anticholinergic medications.

A male patient, age 48 after a fall from 2m high, and subsequent GCS: 10/15, post traumatic amnesia for 7 days, complete T11 paraplegia. At PRM admission, he was occasionally agitated, with attention and memory deficits, had bilateral hip heterotopic ossifications and complete flaccid paraplegia on antiepileptic, antipsychotic and antidepressive medications.

Medication modification in both increased participation in treatment, with Pittsburgh rehabilitation participation scale rising form good to excellent and from fair to very good correspondingly.

Discussion: While the neuropsychological examination, especially in mild TBI, might have reduced sensitivity[8], meticulous attention to patients' acute phase history combined with neuroradiological examination up to 2-3 months after injury can provide us with evidence of brain lesions[9]. Even in low force injuries (where TBI is most often overlooked)[10] rehabilitation participation can be increased.

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OC6

Hereditary Spastic Paraplegia. The Need for an Interdisciplinary Spasticity Clinic: Case Report

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Introduction: Hereditary spastic paraplegia (HSP) is a clinical and genetical heterogenous group of conditions with the main characteristic of spasticity and weakness of the lower limbs[1]. Having a similar incidence with other inherited neurological diseases[2], and a relatively small burden on life expectancy, HSP is a significant cause of disability[1]. Even in the most common pure form, besides spasticity, walking and balance impairments[3], neurogenic gastrointestinal and urological impairments[4,5] can also be found, as well as sensory[6] and cognitive[1] ones.

Case presentation: Patient, age 53, was referred from the neurology outpatient clinic to the spasticity clinic, diagnosed with hereditary spastic paraplegia 8 years ago, with walking difficulties, neurogenic bladder, neuropathic pain and fatigue. After failure of antispastic medication, an intrathecal baclofen trial was performed followed by pump implantation and a rehabilitation programme with significant improvement in walking pattern (Tinetti Gait score: 3 to 8/12) and balance (Berg balance: 38 to 45/56). Simultaneously, medical treatment of the other disturbances led to significant improvement in his quality of life (WHOQoLBREF 50% to 75%).

Discussion: Despite the significant progress in identifying the genetic cause of HSP[7], the need for symptomatic management persists. The multiple drug interventions needed[2], the systematic study of interventions like botulinum toxin[8] and baclofen pump[9] as well as urological dysfunction[4] and pain[2], can all be met in an organized interdisciplinary spasticity clinic inside a general hospital. Following the evidence-based position of UEMS-PRM for spinal cord injuries[10] and taking into consideration the obvious similarities with HSP, the need for more equivalent structures in general hospitals is imperative.

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OC7

Complex Regional Pain Syndrome in Spinal Cord Injury - Case Report

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Introduction: Chronic pain is common after spinal cord injury (2/3 of patients)[1]. The complex regional pain syndrome is characterized by pain combined with sensory, trophic, motor and autonomic disturbances[2]. Prevalence in SCI was found 10% in a retrospective study[3]. Treatment efforts include low dose of corticosteroids, bisphosphonates, anti-neuropathic pain drugs, sympathetic blocks and others[4], with rehabilitation measures having a role[5].

Case presentation: A male patient, age 52, was admitted in the PRM department with A4 tetraplegia after reported alcohol intoxication and fall. Signs of disc protrusion and myelopathy in C3-C5 levels were identified in the cervical spinal cord MRI, and cervical fusion was performed acutely. After the first month, spasticity and dysreflexia episodes dramatically increased, oedema, hyperalgesia and allodynia appeared in his right hand. Electrodiagnostic studies were negative for nerve injury and hand X-ray was positive for osteoporosis. CRPS I was diagnosed, corticosteroids and contrast baths were started with some relief. Due to osteopenia found in bone density exam, bisphosphonates

were given. In parallel, generalized spasticity and dysreflexia episodes were reduced. The patient had motor improvement only after CRPS was controlled, and now can move independently with an electric wheelchair, being AIS A, A5 motor level.

Discussion: Neuropathic pain, spasticity and dysreflexia can create a viscous cycle[1,6]. CRPS treatment is much harder than it's diagnosis[7] still being a challenge[8], much more so in spinal cord injury. Physical agents and desensitization techniques do have an important role[9], while in combination with other conservative and interventional techniques pain can be alleviated[5,10].

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OC8

Microsurgical Selective Peripheral Neurotomy for the Treatment of Focal Spasticity on Lower and Upper Limb - Surgical Technique and Outcome

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Objective: To manage refractory focal -upper and lower limb- spasticity, selective peripheral neurotomy (SPN) is proposed when the spastic muscles to be treated are under the control of a single or a few peripheral nerves. SPN aim at rebalancing the tonicity of agonist and antagonist muscular groups by reducing excessive spasticity without a suppression of the useful muscular tone or an impairment of the residual motor and sensory functions[1]. Peripheral neurotomy can be made "selective" by fine microsurgical anatomical dissection of the fascicles and their mapping by intraoperative electrical nerve stimulation.

Methods: During the last year (2018-2019), 12 patients with disabling upper and/or lower limb spasticity were selected by a multidisciplinary team using clinical, and functional scales as well as nerve block tests for assessment. 23 SPNs were performed at the level of musculocutaneous (5), median (4), ulnar (4), tibial (10) nerves.

Results: On a follow up (mean 6 months) showed significant improvement on: 1) range of motion, resting position, active amplitude, and motor strength; 2) Ashworth scoring; 3) stance-swing gait re-imbalance; 4) hand function assessment and 5) rating of daily activities. Three patients with severe painful spasticity of lower limb experienced complete pain relief after surgery. There were no complications such as hypesthesia or neuropathic pain.

Conclusions: Selective peripheral neurotomy leads to satisfactory improvement in function and/or comfort with a low morbidity rate in appropriately selected patients suffering from severe harmful spasticity of the upper limb and lower limb that has been refractory to conservative therapy. Patients must be selected after complete assessment by a multidisciplinary team.

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OC9

Application of the Mechanostat Theory of Bone and Muscle in Spinal Cord Injury: from Theory into Practice

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Objective: According to the mechanostat theory, bone growth and bone loss is stimulated by the peak forces caused by muscles. Spinal cord injury (SCI) causes inactivation and unloading of affected skeletal muscle and bone[1].

Methods: This cross-sectional study investigated correlations of muscle and bone in spinal cord injured compared with able-bodied subjects. Thirty-one paraplegics (AIS A, mean duration of paralysis: 5.6±6 years, mean age: 39.23±15 years) were compared with 50 controls. All were examined with peripheral quantitative computed tomography (pQCT XCT-3000, Stratec Medizintechnik, Pforzheim, Germany) in the tibia. Images were taken at 66% of the tibia's length. Measured parameters were bone (cortical) area, muscle area, and bone / muscle area ratio.

Results: SCI-paraplegic group differed significantly from control group according to bone and muscle area ($p<0.001$). In paraplegics less muscle per unit of bone area (bone/muscle area ratio) was found compared to controls ($p<0.001$). Bone area was negatively correlated with the duration of paralysis in paraplegic group ($r= -0.66$, $p<0.001$). On the contrary muscle area and bone/muscle

ratio area correlations in paraplegic group with duration of paralysis were weak. Paraplegic subjects who performed standing and therapeutic walking had significantly higher bone area (p=0.02 and p=0.013, respectively).

Conclusions: Bone loss was ongoing during paralysis following muscle loss to reach the new steady state[2]. This conclusion suggests that we could early interfere in the mechanostat process either on bone (mostly giving drugs) or on muscles through exercise protocols or various physical and mechanical means (i.e. functional electro stimulation (FES), vibration platforms etc.) and opens a new perspective on how to manage bone-muscle loss in SCI even in chronic paraplegics.

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OC10

Obesity: A Neglected Problem in Spinal Cord Injury

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Objective: Obesity is a common complication of spinal cord injury (SCI)[1,2].

The aim of the present study was to assess obesity by anthropometric and densitometric measurements in SCI.

Methods: Thirty-one subjects with complete SCI (AIS A) separated according to the neurological level in group A (n=16, high paraplegia: above the seventh thoracic neurological level) and group B (n=15, low paraplegia) were compared with 33 controls. For the assessment of obesity, we used body mass index (BMI) and dual energy X-ray absorptiometry (DXA, Norland, USA) for calculation of total body at in grams (fat mass).

Results: BMI values for paraplegic population were statistically lower compared to control group (23.9±3 and 26.2±4, respectively, p=0.025) and within the normal range of BMI. However, the comparison according to neurological level of injury revealed a significant difference between high paraplegics and controls (22.9±2.2 and 26.1±4, respectively, p=0.021). Using DXA fat mass was increased in body composition in paraplegics compared with controls (23071.38±9485 and 19015±6553, respectively, p<0.05). The correlation of BMI with fat mass was statistically significant between paraplegics and controls (r=0.57, p=0001 and r=0.73, p=0.0001, respectively). In paraplegics total fat mass measured by DXA was increased at any given BMI value compared to the control group (r^2=0.3 vs. r^2=0.54, respectively). Further analysis between the two paraplegic groups showed a significant correlation between BMI and fat mass only in the group of low paraplegia (r=0.72, p=0.004).

Conclusions: The BMI is often used as a measure of obesity but assess body composition inadequately[1]. The whole body DXA gives valuable clinical information regardless of the neurological level of injury.

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OC11

Osteosarcopenia in Chronic Paraplegia

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Objective: In spinal cord injury (SCI) the relationship between reduced muscle mass (secondary sarcopenia) in lower limbs and bone mineral density is unclear.

This study investigated this relationship using the current definitions of sarcopenia.

Methods: Thirty-one paraplegic men, AIS A, T4-T12 neurological level of injury, mean age 39.23±15 years (yrs.), duration of paralysis: 5.7±5 yrs. were compared with 33 similar controls. Whole body dual X-ray absorptiometry (NORLAND X-36, Wis., USA) was used for estimation of regional (upper and lower limbs) and total body bone mineral density (BMD) (gr), lean and fat tissue mass (kg), and percent. Sarcopenia was defined by low muscle mass (skeletal muscle index, SMI), as well as by the residual method (relative appendicular skeletal mass, RASM), respectively.

Results: We found a difference between paraplegic and controls in the rate of sarcopenia of our group according to sarcopenia definitions. Paraplegics had lower values on RASM (p<0.001), total BMD (p<0.001) and SMI (p<0.001) compared to controls. Individuals with sarcopenia (in both groups) had a lower total BMD score (p=0.05) compared to no sarcopenic subjects.

Conclusions: There is no clear evidence if muscle impairment in SCI can be assessed with the current definitions of sarcopenia (assessment of muscle mass)[1]. The relationship between bone and muscle was consistent in able-bodied and predictably altered in those with spinal cord injury, a clinical disease affecting bone and muscle.

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OC12

Length of Stay Efficiency of Spinal Cord Injury Patient's Rehabilitation

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Objectives: Estimation of how effective is hospitalization time of SCI patients, that is, to estimate the functional gain per day of inpatient rehabilitation.

Method: We refer to 86 patients admitted 2017 and 2018 in our center, of whom 64 had SCI (m=46 and f=18, mean age=48.5 years) and 22 cauda equina syndrome (m=15 and f=7, mean age=52,3 years). Of the 64 patients with myelopathy, 14 had tumor (mean age=54.6 years). All patients follow a well-organized rehabilitation program, which included task-oriented approaches and education on activities of daily living. Their functional status was objectively assessed by Functional Independence Measure (FIM), 3 days after admission and 3 days before discharge. For estimation of length of Stay efficiency, the difference in FIM value, which indicate the improvement was divided by the days of hospitalization.

Results: The FIM difference in subjects with SCI was 54.19 with a mean duration in the unit of 64 days, ie LoS Ef=0,84, while patients with tumor had a LoS Ef=0,76. Patients with cauda equina syndrome had a FIM difference 47.75, with mean duration of 39 days. ie LoS Ef=1,22. If we analyze patients with the level of injury, the FIM difference in complete tetraplegia was 41.61 with mean stay 112 days, ie LoS Ef=0.37 and incomplete tetraplegia 60.57 with mean stay of 72 days, ie LoS Ef=0,84, The FIM difference for complete paraplegia was 55.35 with mean stay of 68 days and ie LoS Ef=0,81 and for incomplete paraplegia was 65.98 with mean duration of 48 days, ie LoS Ef=1.37

Conclusion: It seems clear that as LoS decreases and the FIM difference increases, there is a remarkable increase of LoS Efficiency (in the USA it is close to 3). There is also a clear distinction between complete and incomplete lesions.

OC13

Extreme Weather Events and Persons with Disabilities. Need for Action

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Considering the past first, evidence shows that for 160000 years, CO_2 concentrations in the atmosphere have been relatively stable with absolute maximums at ~300 ppm, thus providing climate stability (temperature etc.). Climate sensitivity[2], meaning the temperature increase for increasing CO_2 concentration, has a value of +3°C for double the CO_2 concentration, so for measurements of 420-450 ppm today, it is obvious that we have an increase of 1,5°C globally. Average temperature increase is essentially global warming, which is the cause of extreme weather phenomena (hurricanes, extreme rain levels, forest fires etc.), shifting of the seasons and relocation of the climate zones. High CO_2 concentration also means a lowering of air quality (especially in urban environments).

All of the above can obviously cause problems to humans and the ecosystems in general. Focusing on persons with severe movement disabilities (S.M.D.Ps.), it is rather obvious on how they are impacted by climate change. US studies[3,4] have shown that global warming is the primary cause of an increase to both heat and air-related deaths, illnesses and hospitalizations, including an even bigger increase when it comes to vulnerable groups. Extreme weather events as mentioned, also pose dangers, not only because of the additional difficulty when it comes to being socially active, which on its own includes a psychologic side, an area where S.M.D.Ps. also face issues, but also because of the dangers accompanying an emergency exit from a house.

The Day for Tomorrow[5] is an action aimed to mobilize individuals about climate change, especially when considering the problems that S.M.D.Ps. are facing because of it. It is an initiation aimed to have people walk or wheel annually to express and highlight how people with disabilities are affected by climate change, an area often overlooked.

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OC14

Rehabilitation Team and Individuals with Chronic Spinal Cord Injury. The Significance of Regular Follow-up

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Introduction: Individuals with spinal cord injury (SCI) receive specialized rehabilitation services during sub-acute phase of injury into Rehabilitation Centers or Departments. After the first year, when the injury is characterized chronic, patients are regularly followed-up every six- or twelve-months[2].

The purpose of this paper is to present the significance of the regular follow up of individuals with chronic SCI in two cases.

Case report: Case 1. A woman with traumatic SCI, T6 (AIS A), 49 years old, had followed rehabilitation program for 6 months in a foreign country. After that, she lived in an area around a border and she didn't have any follow up. She visited our out-patient facilities, 33 years post SCI, due to increased spasticity, pressure ulcer, repeated urinary tract infections and depressive disorder. Patient's assessment by the rehabilitation team was followed by setting goals of a rehabilitation program in an out-patient basis for 4 months. Health issues were improved including psychological dysfunction

improving her social reintegration. Since then, she is in annual follow-up.

Case 2. A man with traumatic SCI, T10 (AIS A), 25 years old, was initially hospitalized in a Rehabilitation Center of our country for seven months, and then he returned to his town with no follow-up by the rehabilitation team. He visited our facilities four years post SCI, due to severe complications such as multiple pressure injuries and contractions of joints. He underwent an in-patient rehabilitation program for 5 weeks. Patient refused to cooperate with the psychologist and face the severity of his disability. On his own initiative he decided to stop the in-patient rehabilitation program. The patient is encouraged anyway to continue follow-up in our facilities.

Discussion: The interaction between rehabilitation team and individuals with chronic SCI during regular follow-up is very important[1,3] and has an impact not only on the prevention and management of complications but on keeping empowering patients and their family during social reintegration post SCI. Subsequently, the quality of life-related to health issues is affected positively[1].

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OC15

Prevention of Pressure Ulcers During Acute and Chronic Phase of Individuals with Spinal Cord Injury

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Introduction: Pressure ulcers (PU) are the most common and severe complication of individuals with spinal cord injury (SCI). PU develop rapidly but heal very slowlyand their management has high cost and impact on the quality of life[3]. Prevention strategies are very important in the acute phase by the nursing facility and in the chronic phase by patients and their caregivers[1].

Case report: A 26-year-old-male individual with traumatic SCI T10 (AIS A), admitted at our Rehab-center in the sub-acute phase. During 1st assessment, patient presented a large PU (4th degree) at the coccygeal & sacral area. There was a smaller PU at the right heel (3rd degree). The patient underwent a comprehensive Rehabilitation program for 8 months. At discharge, PU were completely healed. Unfortunately, one year after discharge, patient presented recurrent multiple pressure ulcers (trochanters, heels, gluteus), his personal choices and the influence of his significant ones had an impact on accepting the disability and adopt healthy ways of living. He underestimated the risk of further deterioration of his health condition and he refused his re-admission to the hospital, despite our suggestion. Simultaneously, his spasticity increased, and further decline of his functional situation occurred.

Conclusions: Prevention of PU is very important and defines the quality of life. Nursing facilities have the obligation to prevent PU at the acute phase[3]. Rehabilitation team educates the patient and his/her caregivers in the prevention and management of PU. Finally, during regular follow-up patients should be educated to make prevention strategies a way of lifestyle[1,2].

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Posters

P1

The Challenge of Clean Intermittent Self-Catheterization for Patients with Tetraplegia Level C5

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Objectives: To present 11 C5 tetraplegic patients who were able to perform clean intermittent self-catheterization (CISC), without assistive device but with some assistance from their caregivers.

Method: From 2014 to 2018, twenty-five C5 tetraplegic patients were admitted to our Rehabilitation Department. They were evaluated with the ASIA Impairment Scale and the Box and Block test to evaluate upper limbs gross manual dexterity. Fifteen patients matched our criteria: Box and Block test score >15 blocks/min, age <60 years, appropriate body type, and strong will to achieve CISC. Patients were trained to perform CISC and to improve their grip strength and endurance. Caregivers were trained in preparation of catheterization. Insertion, manipulations and removal of the catheter had to be performed by the patients.

Results: Eleven out of twenty-five C5 tetraplegic patients, achieved to perform CISC without assistive device but with some assistance during the preparation process from their caregivers.

Conclusions: Spinal cord injuries lead to motor and urinary impairments such as detrusor hyperactivity and detrusor - sphincter dyssynergia. CISC combined with medication has been identified as the main treating option for neurogenic bladder management. C5 tetraplegic patients are not able to perform independent CISC, due to poor arm function. In our study, C5 tetraplegic patients were trained to perform CISC without assistive device but with some assistance from their caregivers, succeeding in neurogenic bladder management and achieving high levels of independency.

P2

Regional Rehabilitation Services for Patients with Spinal Cord Injury in Post Acute and Chronic Phase

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Introduction: Spinal cord injury (SCI) leads to serious disability and complications which are associated with functional limitations, reduced participation in daily activities, resulting in loss of work that brings psychosocial problems, economic difficulties and consequently an altered quality of life[1].

The role of regional rehabilitation services is of great importance in order to help patients to return home as independent and productive as possible, prepared to resume their lives.The treatment and rehabilitation process of SCI is long, expensive and requires a multidisciplinary approach.Specially trained therapy professionals work as a team with the patients and family members to enable them to return home at their highest level of independence[2,3].

Case presentation: The patients' target group of the Center of Physical and Rehabilitation Medicine (ΚΕΦΙΑΠ) of Korinthos refers to those who were recently injured (post acute phase) as well as to those who have returned to the community and need continued care (chronic phase). As a developing public rehabilitation center, our goal is to establish a basic transitional SCI unit, specialized units for the management of neuropathic pain, neurogenic bladder and bowel, spasticity,improvement of bone health,consultation for the appropriate assistive devices, educational and informative programs for patients, caregivers and local community. Regional rehabilitation services target in lowering the costs needed for high quality **specialized services for SCI**[4,5].

Discussion: In conclusion, the identification of persons with SCI needs in chronic phase, the provision of long term follow-up and the maintenance of their functional capacity during aging and their social and vocational integration are challenges that the rehabilitation team has to face at a local and regional level.

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P3

Does Ossification of Posterior Longitudinal Ligament Predispose to Spinal Cord Injury? Case Presentation and Literature Review

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Introduction: Ossification of the posterior longitudinal ligament (OPLL) involves heterotopic ossification of spinal ligaments, possibly induced by genetic, lifestyle and metabolic factors. OPLL is a common cause of cervical compressive myelopathy in East Asia, although OPLL can be encountered in any patient population.

Case presentation: A 62-year-old Caucasian man was admitted to authors' department due to severe neck pain and inability to move his extremities after car accident. Physical examination revealed incomplete quadriplegia, while imaging studies revealed OPLL of cervical spine and interfacetal fracture-dislocation of C6-C7 vertebrae. We performed posterior instrumentation from C2-T3. The patient had a partial recovery in upper extremities and he finally manage to move his wheelchair.

Discussion: Physicians should be aware that OPLL is usually associated with spinal canal narrowing and increased rigidity of the affected vertebrae, leading to acute spinal cord injuries, even with minor trauma. OPLL is a subtype of diffuse idiopathic skeletal hyperostosis (DISH). So, DISH, OPLL and ankylosed spondylitis share similar fracture patterns. In all the above-mentioned situations the spine become rigid, without movement and segmental forces and finally ends up with osteopenia and vulnerability to trauma. Decrease in bone mineral density associated with aging and degenerative changes in bone and ligaments contribute also to this vulnerability. All the above-mentioned diseases predispose to three column fractures with or without neurological deterioration and clinicians should be aware for potential spinal cord injury. Furthermore, when OPLL is identified, patients should be informed detaily, in order to reduce the spinal cord injury cases.

P4

The Trauma of Spine in the Ancient Times

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Introduction: Spinal trauma has been diagnosed or treated since antiquity. Our scientific team attempt to record information about spine, from the prehistoric to Roman times. We would like to focus is on Hippocrates and Galen, who as the most famous physicians of the ancient world, and we present their work on spinal pathology. Our team searched the Galen's work in Khun's edition (Leipzig, 1829) which is available in both ancient Greek and Latin. Galen's contains the medical Hippocratic knowledge, but also his own opinions and thoughts.

Discussion: Khun's edition of Gulens works is reliable source of ancient medicine. Galen is the authority in the ancient times because his work contains all the accumulated knowledge of the ancient world. Another conclusion is the timelessness of Hippocratic opinions are. The treatment of neurological deficits by spinal trauma (tuberculous spondylitis) including, until today, cold abscesses still remain accurate. Also, the modern orthopedic table is evolution of Hippocratic table. In addition, the practice of opening the patients' abdomen to reduce the anteriorly displaced vertebrae is the new anterior fixation.

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P5

Efficacy of Task Oriented Interventions in Spinal Cord Injury Patients, as Measured by Functional Independence Measure - FIM

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Objectives: To assess the contribution of task oriented interventions, such as walking with robotic assistance with virtual reality guidance (lokomat), or the application of kinesiotherapy programs in the water environment, to the final functional outcome as assessed by the Functional Independence Measure (FIM). To answer the clinical question of whether these interventions contribute to functional gain of the program applied.

Method: We refer to 86 patients admitted to our inpatient rehabilitation unit, 2017 and 2018. Sixty-four of them had SCI (m=46 and f=18, mean age=48.5 years) and 22 patients had cauda equina syndrome (m=15 and f=7, mean age=52,3 years). All patients (n=64) follow a standard rehabilitation program of functional reeducation on activities of daily living, as well as for social reintegration. Of them, 26 followed additionally hydrotherapy programs and 32 followed walking training with robotic assistance (lokomat). The functional status of the patients was objectively assessed by FIM, 3 days after admission and 3 days before discharge, with interim values, when length of stay exceeds on month. The difference between FIM at admission and discharge demonstrates the functional gain of the program applied.

Results: The FIM at admission for all groups was: total=44,05, Hydro=43,85 and Lokomat=44,55 with FIM at discharge 98,24, 108,95 and 114,68, with the difference as 54,19, 65,10 and 70,13 accordingly.

Conclusions: The evidence suggests that therapeutic interventions target at a specific goal, such as walking training with robotic assistance with virtual reality guidance (lokomat) or aquatic facilitation programs, substantially increase the functional gain of patients, as shown by FIM at discharge (108.95 and 114.68 respectively). There was a small increase in length of stay for these groups but can be attributed to the effort to complete the program.

P6

Rehabilitation Gain in Spinal Cord Injured Patients as Estimated by Functional Independence Measure - FIM

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Objectives: The Rehabilitation cornerstone for SCI patients is the assessment of functional gain, as a result of a well-organized functional rehabilitation program. This assessment is objective and reliable with the assistance of Functional Independence Measure (FIM).

Method: We refer to 86 patients admitted to inpatient rehabilitation unit, 2017 and 2018. Sixty four of them had SCI (m=46 and f=18, mean age=48.5 years) and 22 cauda equina syndrome (m=15 and f=7, mean age=52,3 years). All patients follow a well-organized functional program, which included task-oriented approaches and education on activities of daily living, as well as preparation for social reintegration. Their functional status was objectively assessed by FIM, 3 days after admission and 3 days before discharge, with interim values, when length of stay exceeds on month. The difference between FIM at admission and discharge demonstrates the functional gain of the program applied

Results: In SCI patients, FIM at admission was 44,05 and at discharge 98,24, with 54,19 as FIM difference. The same values for cauda equina syndrome patients was 51,68 and 102,43 with 50,75 as difference. Given the level of lesion, these values vary, for complete and incomplete tetraplegic, as 32,05 (admission) with 73,68 (discharge) with the FIOM difference at 41,62 and 41,23 with 101,80 and difference 60,57 accordingly. For paraplegic patients the values were: for complete lesion, 42,59 and 97,94 with difference at 55,35 and for incomplete lesions 43,17 and 109,15 with difference at 65,98.

Conclusion: The data show that incomplete lesions, at any level, showed more improvement with a serious functional gain, so that they could be transferred quickly to the outpatient setting, reducing length of Stay. Most patients, except those with complete quadriplegia, had FIM values close to the level of independence (> 90).

P7

Anxiety and Depression among Spinal Cord Injured Patients

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Objectives: Spinal cord injury (SCI) often causes severe disabilities and Influences activities of daily living. The degree of functional impairment strongly depends on the level and completeness of lesion (tetraplegic, paraplegic).

The aim of the study was to assess anxiety and depression in patients with incomplete spinal cord injury during rehabilitation.

Methods: We calculated Hospital Anxiety and Depression Scale (HADS-A, HADS-D) in patients with SCI, 4 weeks and 2 months after SCI. Eleven patients participated: (7 men, 4 women) (median age 38, range 17-76) (C7 AIS B, C6 AIS C, C6 AIS B, TH7 AIS C, TH9 AIS C, TH11 AIS B, TH12 AIS C, L1 AIS B, L1 AIS C, L2 AIS C, L4 AIS C).

Results: In 4 weeks 7 (64%) and in 2 months 8 (73%) had anxiety. There was no significant difference in anxiety in 4 weeks and 2 months, but there was significant difference in anxiety between men (57%- 71%) and women (75%- 75%) in 4 weeks (p=0.045). There was significant difference in depression between 4 weeks and 2 months (p=0.002) but no significant difference between gender (p=0,056).

Discussion: Women with SCI are at a significantly higher risk of having anxiety[1,2], but no difference was observed for depression. Depression usually is more common also in women[1]. This difference could be because of the small sample in our study. Depression and anxiety are two psychologically important side effects after SCI, especially among the younger SCI patients[3] and it seems to increase with time, probably due to awareness of disability. Religion and spiritual well-being have a moderating role on occurrence of depression and anxiety[4]. This highlight the need to continue to ensure that appropriate psychological care is available within SCI rehabilitation settings[5].

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P8

Rotator Cuff Impingement Syndrome in a Patient with Paraplegia - a Case Report of Using Perineural Injections Therapy - PIT

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Introduction: Rotator cuff impingement syndrome usually manifesting with pain, stiffness, shoulder ROM reduction, results in limitations of activities of daily living (ADL), necessitating for prompt, effective treatment[3].

Aim: To present the treatment/rehabilitation of a male patient with complete paraplegia T12, AIS A, suffering from Rt shoulder injury during transferring from wheelchair to bed[4].

Case report: Two days after the injury, the patient started complaining of Rt shoulder pain, that affected all ADL, was localized in the anterior-lateral side of the shoulder and assessed with VAS 9/10. Abduction and flexion were partially performed with great difficulty, while extension was easily performed up to 10 degrees.

The patient was treated conservatively with analgesics (paracetamol, codeine - three times/day) and perineural injections (PI) in the painful area with a solution containing D/W 5% and HCO3-, pH 7.5, 3 injections in 3 days (one/day), gradually reducing the injections' frequency in the following 2 months[1]. His rehabilitation program included strengthening exercises of the shoulder girdle muscles and avoidance of stress/weight bearing on the Rt shoulder during ADL.

Results: The patient stopped complaining of pain, with no analgesics needed, and reached full degrees of ROM one month post first PI.

Conclusion: After a shoulder injury, a paraplegic patient needs to modify the way of performing ADL[5]. A method contributing in the effective and relatively quick healing and rehabilitation of such an injury, such as PIT by Lyftogt, is very helpful[1,2]. More studies are needed to confirm the effectiveness of this method.

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P9

Patients with Spinal Cord Injuries Following Rehabilitation Program in our Center the Last 5 Years: Causes, Related Problems and Complications

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Introduction: The term "Spinal Cord Injury" [SCI] includes all the lesions of the spinal cord, conus medullaris and cauda equina, that result in sensory and motor function loss of the upper and lower limbs, the trunk, along with autonomic function loss[1,2].

Aim: To record data regarding the patients with SCI who have been treated in our center the last five years, the causes, related problems and complications.

Method: The data were collected from the medical records of 66 patients with SCI who were hospitalized in our center the last 5 years.

Results: During this period, the average age of the patients with SCI was 49 years old, with the ratio male to female being 3.4:1. The most common causes of traumatic SCI were traffic accidents (25.7%) and falls (24%), while non traumatic SCI represented 37.8% of the total, including neurological, vascular causes, tumours, etc[4,5]. From falls, 6% were due to suicide attempt. Most common problems and complications were related to pain (37%), spasticity (17%), urinary tract infections (15%), pressure ulcers (12%) and orthostatic hypotension (11%)[3].

Conclusion: Preventive measures for the reduction of the most common causes of SCI (traffic accidents and falls), and of the complications and problems that can delay the rehabilitation of these patients, should be engaged.

Keywords: Spinal Cord Injury (SCI), causes, problems, complications, rehabilitation.

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P10

Dorsal Rhizotomy in an Adolescent with Spastic Paraplegia

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Intoduction: Dorsal rhizotomy, under appropriate indications, is an effective surgical treatment for spastic diplegic children suffering from cerebral palsy[1]. We present a case of a non-cerebral palsy adolescent with familiar spastic paraplegia type 4 (SPG4) treated by Keyhole Interlaminar Dorsal Rhizotomy (KIDr)[2].

Case presentation: A 15 y/o boy with familiar spastic paraplegia (mutation c.1496G>A(p.R499H) for SPG4 gene. He was non-ambulatory on functional status GMF-CS III unable to walk without assistive devices and caregivers support. The Ashworth scale for lower limbs was 4 with inexhaustible clonus. In standing position he was in hyperlordotic painful lumbosacral contracture, scissor-like adduction and equino-varus. KIDr was performed with two interlaminar spaces, preselected according to planning. At L1-L2 (for L2/L3 roots) and L5-S1 (for S1/S2 roots) were enlarged, respecting the spinous processes and interspinous ligaments. Ventral root stimulation identified the radicular level. Dorsal root stimulation evaluated its implication in the hyperactive segmental circuits, helping quantify the percentage of rootlets to be cut[3]. The amount of root sectioning bilaterally was: L2 75%, L3 50% and S1 75%. The excess of spasticity was immediately reduced. The Ashworth score decreased to O, with no clonus, abnormal painful postures. In six-month follow-up the boy is on GMF-CS II, able to walk independently without assistive devices.

Discussion: The efficiency and safety of dorsal rhizotomy lie in the accuracy of radicular identification together with selectivity of root sectioning. We report, for the first time, the case of an adolescent who underwent dorsal rhizotomy for the management of spasticity secondary SPG4.

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P11

Caregivers of Individuals with Spinal Cord Injury as Members of the Rehabilitation Team

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Objectives: The spinal cord injury (SCI) leads to dysfunction of multiple organs and systems of the organism, which affects the functioning of the person. Individuals with severe and multiple disabilities need the support of trained caregivers (CG)[1]. The training of CG during the initial inpatient rehabilitation program is analysed.

Methods: Data conserning CG of individuals with severe SCI, that have been hospitalized in our Centre, were analysed. The educational level of CG, the degree of relationship between the patient and CG, the cooperation of CG with the rehabilitation team, the willingness of CG to participate in educational processes concerning the management of several dysfunctions post SCI were studied at 15 days (T1)and at 4 months (T2).

Results: Seventeen CG (M:6, F:11) of individuals with severe disability post SCI, that have been hospitalized in our Centre, were studied. The average of patients' hospitalization was 8 months. Almost all CG had first-degree relationship and only one CG received compensation for his services. Sixty percent of CG had low to very low educational state. Six caregivers were from another country or immigrants. At T1, 70% of CG behaved as scared and introverts, 4CG where especially demanding although their good educational state. At T2, 80% of CG changed their behavior, but their cooperation with the team varied depending on the particular member of the team. Their cooperation was very good with the therapists, but poor with the nurses, although nursing staff was spending more time with the patients. Only two CG refused to participate and collaborate with the rehabilitation team, because of fear.

Conclusions: The SCI-caregivers need special training, which must be obligated, and psychological support[1], in order to improve the quality of life of individuals with SCI[2,3] and to help them to reach a high level of functionality.

Keywods: Caregiver, Spinal Cord Injury, Behavior, Education, Rehabilitation, Quality of life, Independence

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