

Complex Neuro-Muscular favorable rehabilitation program of a patient with polytrauma including spinal cord injury and multiple bone fractures

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Abstract

Introduction: Polytrauma which include spinal cord injuries but are associated with other traumatic events such as limb fractures, generate through their complexity the necessity of a thorough neuro-muscular rehabilitation programme with a long-term aim of reflecting the improvement of the patient's quality of life.

Materials and Methods: This paper presents the case of a 43-year-old patient (having the The Teaching Emergency Hospital "Bagdasar-Arseni", TEHBA, Bioethics Committee approval no 9181/11.04.2018), who is hospitalized in our Neuro-muscular Clinic presenting incomplete AIS / Frankel C tetraplegia with C4 neurological level and neurogenic bladder and bowel. Also she associated multiple fractures such as: left scapular fractures, right humerus fracture (surgically stabilized), pelvic fractures, right fibular head fracture without displacement. This polytrauma was caused by a car accident (pedestrian 9.11.2017). At admission the patient had severe motor and functional impairment and was assessed functionally using the following scales: AIS / Frankel, modified Ashworth, Functional Independence Measure (FIM), Life Quality Assessment (QOL), FAC International Scale, Independence Assessment Scale in Daily Activities (ADL / IADL), Walking Scale for Spinal Cord Injury (WISCI).

Results: The patient benefited from a complex neuro-muscular rehabilitation programme, having a favourable evolution, therefore the patient reaches incomplete AIS / Frankel D tetraplegia with an increase in the evaluated scales scores and thus, with a final performance of walking for short distances with a supporting frame, as well as a sphincter re-education with the neurogenic bladder remission.

Conclusions: Based on the collaboration with orthopedic and surgeon fellows the PRM physician developed a complex rehabilitation programme leading to the re-expression of locomotion function, sphincterian control recovery, selfcare ability, all of the mentioned factors improving the patient's quality of life.

Key words: *rehabilitation, traumatic brain injury, bone fractures, polytrauma*

Introduction

Spinal cord injuries secondary to motor vehicle accidents are amongst the most dangerous injuries, leading to high mortality and morbidity. Injured patients are occasionally faced with life-threatening complications and quality-of-life changing neurological deficits. Thoracic and cervical spinal segments are the most effected sites of injury and a wide range of complications including paraplegia, respiratory and cardiovascular compromise secondary to autonomic dysfunction or tetraplegia may ensue.^{1,2}

Spinal cord injury (SCI) is an injury causing temporary or permanent damage to the motor, sensory and autonomic function of the spinal cord. Generally, permanent and progressive neurological disorders are seen. Life threatening complications and neurological disorders affecting quality of life can develop in these patients.^{1,2}

Polytrauma which include spinal cord injuries but are associated with other traumatic events such as limb

fractures, generate through their complexity the necessity of a thorough neuro-muscular rehabilitation program with a long-term aim of reflecting the improvement of the patient's quality of life.³

Most common causes of SCI trauma are: risk takers, auto accidents (flexion injuries), motorcycle accidents, falls (hyperextension injuries), and sports mishaps; diving incidents (compression injury), gunshot/knife wounds.^{3,4}

SCI involves complete or incomplete spinal cord lesions. If complete injury occur no sensory or motor function are seen below the level of the lesion; it is caused by a complete transection (or severing), severe compression, or extensive vascular impairment to the spinal cord. In incomplete injury some preservation of sensory or motor function below the level of injury are detected; often it result from contusions produced by pressure on the cord or swelling within the spinal canal. Clinical picture is unpredictable.^{1,2}

According injury' level SCI yields tetraplegia if cervical spinal cord is affected or paraplegia, in case

of thoracic and lumbar injuries, or sacral roots Tetraplegia involves of all four extremities and the trunk, including the respiratory muscles (C4 innervated). Paraplegia involves all or part of the trunk and both lower extremities.^{1,2}

Materials and Methods:

This paper presents the case of a patient having The Teaching Emergency Hospital “Bagdasar-Arseni”, TEHBA, Bioethics Committee approval no 9181/11.04.2018.

A 43 years old female was admitted in our Neuro-muscular clinic division presenting: tetraplegia with incomplete motor deficit, bladder and bowel disorder, sensory dysfunction, acute pain located in the shoulders, pelvis and lower limbs, severe locomotors and self-care impairment

Family history was insignificant.

From personal medical history we underline the patient was involvement in a traffic accident (pedestrian 9.11.2017) which caused: incomplete AIS / Frankel C tetraplegia with C4 neurological level (surgical intervention in 24 November 2017), neurogenic bladder and bowel, multiple fractures such as: left scapular fractures, right humerus fracture (surgically stabilized -12 feb 2018), pelvic fractures, right fibular head fracture without displacement, thoracic (bilateral pneumothorax) and abdominal injuries.

The admitting diagnosis was C4 SCI. Based on the American Spinal Injury Association Impairment Scale (AIS), the lesion was designated as a Category C: Incomplete. Sensory and motor function is preserved below the neurological level and includes the sacral segments S4-S5. The patient was admitted wearing a cervical orthosis. The C4 fracture was surgically stabilized in the Neurosurgery clinic division (24.11.2017). The right proximal humerus fracture which was classified as Neer 4 category was initially conservatory treated: ‘immobilisation’ and support of the injured arm in a sling/Dessault’s bandage for around 3-4 weeks. Then it was surgically stabilized that involved internal reduction and replacement of the humeral head with a hemiarthroplasty (12.02.2018)

Clinical examination at admission revealed: patient conscious, alert, cooperant, temporo-spatial orientated, no special facial expression, right shoulder, right antero-lateral cervical post-op closed scars. Cardiovascular system had normal heart sound,

no added sounds or murmur, blood pressure 110/65 mmHg, heart rate 91 bpm. Respiratory system: bilateral equal air entry, normal vesicular breathing, peripheral oxygen saturation (SpO₂) 99%. Osteoarticular system had multiple bone fractures: left scapular fractures, right humerus fracture (surgically stabilized), pelvic fractures, right fibular head fracture without displacement. Gastrointestinal system had distended abdomen, no tenderness, and slow intestinal transit. Urogenital apparatus: neurogenic bladder with currently spontaneous urinations in diapers for adults and history of Foley catheter at first admission.

Local clinical examination at admission revealed: normal cranial nerves examination, increased upper limb muscular tonus at first admission - 1 Ashworth and then at second admission - no increase in muscle tone. As for lower limb muscular tonus, initially it was increased at 1 on Ashworth scale and at second admission it was normal. Patient had lower and upper limb motor control present, patellar reflex and Achilles reflex present, Babinski reflex present at the left leg, cutaneous plantar reflex: indifferent at the right leg. Functional: at first admission the patient kept bed rest and at second admission she performs the walking with unilateral support for short distances. ASIA motor exam points were 25/50 for upper limbs and 35 /50for lower limbs. ASIA sensory exam score were 62/ 112 points for light touch and 62/112 points for pin prick.

FIM cognitive subtotal score was assessed with a result of 35 points. The Quality of Life Scale at admission was measured at 88/112 points.

Paraclinical investigations are summarized in table 1

Name	Value at admission	Normal value
VSH	90	6-11 mm/h
HGB	10.61	12-18 mg/dl
HCT	32.23	36-54%
Fibrinogen	686	169-515 mg/dl
Albumin	2.7	3.4-5 mg/dl
AST/GOT	130	15-37mg/dl
ALT/GPT	247	14-59mg/dl

Cervical vertebrae X-ray showed osteosynthesis material for the C3-C5 fracture. Right proximal humerus fracture which is subsequent surgically stabilized was X-ray emphasized too. Also, right fibular head fracture without displacement that was conservatory treated

During the hospitalization the patient was evaluated by doctors from several specialties: (1) Orthopedics for the multiple fracture especially the right proximal humerus fracture which is subsequent surgically stabilized.(2)Neurosurgical: reevaluation of the surgical wound (3) Infectious: for the urinary tract infection discovered.

The main diagnostic at discharge was: AIS / Frankel (D) tetraplegia with C4 neurological level after a cervical SCI (C4-C5 fracture/dislocation) in polytraumatic context (car accident-pedestrian 9.11.2017). Multiple bone fractures such as: left scapular fractures, right humerus fracture (surgically stabilized), pelvic fractures, right fibular head fracture without displacement. Thoracic and abdominal contusion, bilateral pneumothorax. Neurogenic bladder, in remission. Neurogenic bowel retention type.

For the rehabilitation program we had the main general objectives: (1) Combating pain and regaining functionality that allows the patient self-grooming and locomotion (2) Treating orthopedic and infectious diseases associated and preventing complications (3) Improving the patient's psychocognitive / mental and emotional status (4) Socio-professional, respectively family reestablishment in order to improve patient's quality of life.

Rehabilitation program specific first mean is Hygienic-dietary regime consisting in suitable hydration (1,5-2l/zi), rich regime that includes vitamins, minerals, and should avoid fermenting foods (beans, peas) but with a proper fiber intake for maintaining a healthy gut transit.

Should avoid skin contact with liquids/objects that are too cold or hot. Avoid cold, moisture, cold air currents, sudden movements, respectively trauma at any level of the spinal cord.

During admission the patient was assessed and treated with the following drugs: anticoagulant pain killer, gastric protector hydro electrolytic rebalancing antispasmodic treatment, antiarrhythmic, urinary disinfectant, antibiotic, iron supplement, neuroprotective drug.

Physiotherapy administered were: Diapulse - pain control with localization in knees and shoulders, LASER for the improvement of the knee and shoulder pain CIMF for neurogenic bladder.

Kinetic objectives followed were:

1. Combating spasticity
2. Restoring / maintaining joint mobility

3. Recovery/ improvement of proximal and intermediate motor control respectively promoting motor control of the upper and lower limbs
4. Reeducation of orthostatism
5. Transfer training
6. Re-training transitions and practicing walking on a physiological basis
7. Promoting functionality of the right upper limb through an occupational therapy program adequate for the patient
8. Sensory reeducation to regain a normal global sensation
9. Cardiorespiratory rehabilitation

Several kinetic means were encountered in the rehabilitation program. To combat spasticity it is recommended dorsal decubitus position with the lower limbs stretched at 90 degrees on the bed sheet, prolonged stretching. To restore and maintain joint mobility: (1) Passive mobilizations that are gently executed at the maximum stretching point/ prolonged stretching (2) Passive-active and active-passive mobilizations (3) Kinetic bed side program: passive mobilizations (4) Kinetic program at the gym: pulley, bicycle (4) Main role: to maintain articular function and to prevent heterotypic ossification with secondary ankylosis. To increase muscle force were performed active mobilizations with resistance: pulley and helmet. For the lower limbs training: exercises at the ergometric bicycle and motomed

Transfer training followed was: changing and maintaining position from dorsal decubitus to shortened seat and transfer from dorsal decubitus to the wheel chair and from the wheel chair to toilet for instance

To maintain verticalization trellis exercises with orthostatic maintenance were done. For practicing walking progressively, initially walking at parallel bars was performed and subsequent walking with supporting frame, respectively walking for short distances with one crutch in the left hand. Occupational therapy targets the re-expression of locomotion function and independence through the upper limbs training.

The right hand (surgically stabilized) was trained in order to reveal mobilizations in functional angles and also emphasis was put on regaining movements of finesse (right shoulder hemiarthroplasty, with restriction of carrying weights up to 3 months).

Training the diaphragmatic breathing – in order to relax and bring a proper oxygen intake that is vital for the rehabilitation program and furthermore for successful results.

Patient's evolution was favourable: functionally improved, the patient has independence in the wheel chair, maintains verticalization and performs walking with unilaterally support (in the left hand) for short distances under strict supervision. At discharge patient had bladder and bowel control recovery. Overall, patient had a moderate locomotion dysfunction and a severe self-care dysfunction.

Ad vitam prognostic was favorable ; Ad functionem was favorable but with slow evolution due to the injuries: tetraplegia associated with multiple bone fractures that make the recovery of the patient more difficult. At labore remanende reserved.

As complications we mentioned urinary tract infection with E.Coli treated.

This case puts great emphasis on the scientific interest that the association between tetraplegia and multiple bone fractures represents. Furthermore this association initially suggests the severe disabilities that occur after polytrauma, yet the severity of this comorbidities through a proper rehabilitation program can bring succesful results and excelent prognostic in the life of these patients, independence of walking, social reintegration and self-grooming being the main goals.

Conclusions

Based on the collaboration with orthopedic and surgeon fellows the PRM physician developed a complex rehabilitation program leading to the re-expression of locomotion function, sphincterian control recovery, self-care ability, all of the mentioned factors improving the patient's quality of life.

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