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The importance of multidisciplinary team in the treatment of severe traumatic brain injury

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Abstract

Noticeable advances have occurred in the field of traumatic brain injury in the past ten years. Brain imagery provides a more precise representation of what occurs in the brain, diffuse axonal injury being an important cause of morbidity and mortality in patients with traumatic brain injury. We present 2 cases that were admitted and discharged from our department. Actually we want to emphasize differences and similarities between the two cases and to highlight different sequelae that traumatic brain injury can do in young patients. Both patients were admitted in a critical state – GCS 4 points and were discharged with an improved neurological status after approximately 30 days. We decided to present these cases to issue a warning about the rehabilitation for these patients which most of the times have a prolonged hospitalization. We wanted to highlight that the rehabilitation does not consist only in the motor part, but in the psychiatric and behaviour part too.

Key words: *rehabilitation, traumatic brain injury, motor sequelae, cognitive impairment,*

Introduction

Traumatic brain injury is said to be a silent epidemic. It is well known the fact that approximately 180-250 persons per 100000 inhabitants die or are hospitalized every year because of traumatic brain injury, most of them being young adults (1). Noticeable advances have occurred in this field in the past ten years. MRI and biomarkers have made a great step forward in predicting recovery in patients with traumatic brain injury. Brain imagery provides a more precise representation of what occurs in the brain, diffuse axonal injury being an important cause of morbidity and mortality in patients with traumatic brain injury. Diffuse axonal injury is actually the result of the stretching and shearing of white matter fibers in the brain. Recently, a number of studies have shown that magnetic resonance diffusion tensor imaging (MR-DTI) seems to be a more sensitive technique for these injuries, making it easier to identify and visualize the lesions as well as to quantify them (2), as for biomarkers nFL has been taken recently into consideration. Recent studies have shown that the higher NfL levels in CSF and serum the bigger the number of concussions and severity of post-concussion symptoms after 1 year (3).

Case reports

We present 2 cases that were admitted and discharged from our department. Actually we want to emphasize differences and similarities between the two cases and to highlight different sequelae that traumatic brain injury can do in young patients.

First case presented is the one of a young man which was brought by the ambulance at the Emergency Department of Sibiu in deep coma (GCS – 4 points), intubated, sedated, mechanically ventilated, secondary to a severe brain trauma. The neurologic exam revealed spontaneous flexion of both arms and miotic, equally in diameter and reactive pupils. The patient was haemodinamically stable, with breath sounds present equally bilateral. The cerebral native CT-scan revealed multiple supra and infratentorial haemorragic contusions. After approximately three weeks he was detubated and he underwent a percutaneous tracheostomy with video-assisted bronchoscopy. His neurological status improved very much: the patient's consciousness was preserved – GCS 15 points, spastic tetraparesis 3/5 MRC, brisk osteotendinous reflexes, bilateral Babinski sign, no coordination and sensitivity problems.

The second case presented is a young man, 20 years old, which was involved in a car accident. His neurological exam was similar to the one presented before: deep coma – GCS 4 points, tetraparesis, bilateral Babinski sign. He was not haemodinamically stable – he underwent a splenectomy surgery. After approximately 14 days his neurological status was better: no motor deficits, no coordination problems, no pathology concerning cranial nerves, but definitely in need with psychiatric medication and behavior and cognitive rehabilitation.

A cerebral MRI was performed in both cases, after approximately 7 days from the moment of the accident. The results were similar and it revealed:multiple contusions with supratentorial and infratentorial haemorragic spots (Figure 1 and Figure 2). It is obviously that in these cases imagery is very important in excluding potential differential diagnostics.

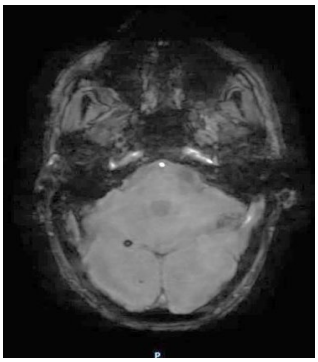

Fig. 1. – SWI sequence – left cerrebelar haemorragic spot

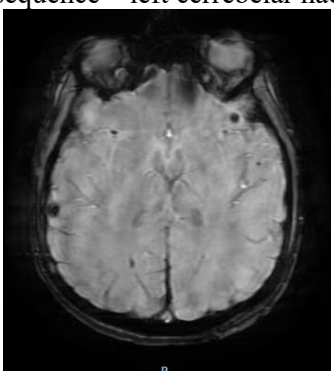

Fig. 2. – SWI sequence – supratentorial haemorragic spot bilateral

They have received supportive treatment with neurotrophics, analgesics and LWMH (low weight molecular heparin) to prevent blood clots.

Both cases presented received rehabilitation therapy from the acute state, helping them to partially recover, but even though they had the same final diagnosis and the same aetiology, the final result after the subacute state was different.

The first case presented was discharged with motor sequelae: spastic tetraparesis 3/5 MRC, problems in coordination – especially fine movements, but no psychological sequelae. The second case presented recovered the motor deficit, he had no problems with coordination, but his cognitive status and behavior were severe affected.

Both of our patients started very early the rehabilitation: simple motor exercises and task specific training and different exercises to train the cognition and the behavior that were sustained by a psychologist. It is known that duration of the rehabilitation therapy is not clearly established. Rehabilitation should provide as much scheduled therapy (occupational therapy and physiotherapy) as possible, with a minimum of three hours a day. The program that both patients followed included: a complete range of motion and strengthening exercises necessary for mobility (that began in in a gravity eliminated plane to allow repetitions without excessive fatigue) and psychological help: educational, goal settings, expressing feelings and thoughts, twice in a day (early morning and late afternoon). It is necessarily to emphasize that the social support is also very important in this journey.

Discussions

We decided to present these cases to issue a warning about the rehabilitation for these patients which most of the times have a prolonged hospitalization. We wanted to highlight that the rehabilitation does not consist only in the motor part, but in the psychiatric and behaviour part too.

In most of the cases the MRI should exclude other diagnostics like: infectious diseases – encephalitis - hyperintensity involving the cortical and the subcortical regions of bilateral temporal, frontal lobes, and insula on T2-weighted images (WI) and there may be associated restricted diffusion, gyral swelling, loss of gray-white matter interface, and mild or no enhancement, tumours – meningiomas, astrocytomas – enhancing or non-enhancing infiltrative lesions in both hemispheres with/without compression of the midline structures and the spectroscopy ratio can exclude or cofirm an intracranial expansive process or even strokes – gold standard sequence – DWI and ADC (2,4). It should be taken into consideration that the exam should be completed with a DTI (diffusion tensor imaging) sequence that can highlight lessions of the white matter tracts by imaging the anisotropy of water diffusion (2).

It should be clearly emphasized that these patients need rehabilitation as fast as possible.

Even though in the acute phase the patient is comatose and the main demand is to save the life and maintain the vital functions, the rehabilitation should be undertaken early to prevent complications (risk of pressure sores) and improve respiratory function (5).

In the subacute phase patients are cooperative, therefore an holistic approach that includes motility, cognition, behaviour, personality and affect should be taken into consideration.

Orthopaedic and neuromotor rehabilitation – recent studies have shown that orthopaedic and neuromotor impairments have a better outcome than cognitive and behavioural disorders. It is said that neurorehabilitation after TBI have a better prognosis than after stroke.

The orthopaedic problems appear due to long lasting immobility in bed during post-traumatic coma. There are joint injuries (shoulder, elbow, hip, knee) that can induce pain and loss of mobility (5). No preventive method has provided evidence of efficacy. Spasticity and non-piramidal muscular hypertonia comprise another big problem in terms of rehabilitation. Intrathecal infusions of baclofen and injection of botulinum toxin have promising effects in these two problems. Evaluation of muscle tone may be scored using the Modified Ashworth Scale (MAS). The MAS provides a 1–5 grading of muscle tone based on resistance in range of motion. Grading spasticity helps to determine treatment effectiveness and monitor for a change in symptoms (5,6).

Infection or noxious stimuli, such as fracture, deep venous thrombosis, or even an intra-abdominal pathology, can increase the level of spasticity. Patients and caregivers should
be educated regarding this phenomenon, as it can be a warning sign for illness or injury. On the other hand it is known that hemiplegia and hemiparesis generally have a good prognosis – 50% showing a good recovery within the first 3 months post-trauma. Studies have shown that approximately 10% of the patients with TBI have a noticeable motor deficit over 9 months (5).

Cognitive and behavioural impairments are the most important sequelae of severe TBI. Cognitive deficits are mainly disorders of selective attention, psychomotor slowing, explicit memory and executive function. Many patients will experience deficits in multiple areas that will persist long into their rehabilitation course. Strategies to improve cognitive function can be pharmacologic or therapy-based. Individual responses to cognitive rehabilitation vary and are heavily influenced by premorbid cognitive function and the ability of the patient to participate
in therapy (5).The presence of infection, metabolic derangements, endocrine dysfunction, seizures, mood disturbance, sleep–wake cycle dysregulation, and sedating medications can exacerbate cognitive impairments. As far as memory is concerned, post traumatic amnesia is an anterograde amnesia. Post traumatic aphasia, apraxia and neglect are very rare. With regard to affect, mood and behavior, anxiety, depressive mood and changes in personality stand as the major disorders (7).

Functional outcome and autonomy depend on physical, cognitive and psychoaffective sequelae. At the end of the rehabilitation around 40% of the patients with TBI remain with severe motor impairments, 50% suffer from cognitive disorders and 60% suffer from pyscoaffective changes. Family life is affected and they need help and support in most of the cases (8). In the literature there are many studies that have approached TBI patients and their life after the accidents. Most of the patients return to work after 2 years from the injury. The rates depend however on the severity of the injury: for example 75-90% from the patients with mild TBI are returning to work, 60-70% after a moderate TBI and only 35-50% of the patients with a severe TBI can continue working (9).

Recent studies have shown that concentrations of neurofilament light (NfL) chain in blood can detect concussion, its severity and help predict recovery in patients with mild traumatic brain injury (TBI). This biomarker may be used to aid in the diagnosis of patients with concussion or mild TBI and to identify individuals at increased risk of developing persistent post-concussive symptoms (PCS) following TBI. Higher CSF and serum NfL levels were associated with a higher number of concussions and severity of PCS after 1 year (1,3). It is well known that biomarkers have been brought in attention lately and used to differentiate the multiple types of dementia. For example, NfL is used for the prediction of dementia secondary to traumatic brain injury, low Aβ42 and increased t-tau or p-tau have also shown their accuracy in the distinction between normal aging and Alzheimer Disease (> 85%) and have a good predictive value in predicting MCI conversion

to AD (> 90%) and astrocytic and oligodendrocytic protein S100B is elevated in a range of conditions—most notably prion diseases (10, 11).

Conclusions

Chronic traumatic encephalopathy is a long-term consequence of single or repetitive closed head injuries for which there is no treatment and no definitive premortem diagnosis. Current research is attempting to identify specific biomarkers along with more sophisticated imaging techniques for the diagnosis of CTE (7). Future research should also be centered around how to manage CTE as suicide is a common fate for those battling the disease. It is also waitedan advance in the rehabilitation field: therapies of the future will have to associate the positive emotional impact of group psychotherapies, the direct influence of cognitive systems, the pragmatic efficacy of social educational and vocational training and last but not least computer assisted therapies (8).

Conflict of interest

No conflict of interest for any of the authors regarding this paper.

Informed consent

An informed consent was obtained from the patients (or the tutor of the patients) included in this article.

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