

# **Patients with brain trauma and brain diseases – the meaning of early rehabilitation**

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## **Summary**

The number of patients with brain diseases, especially with brain tumours, is on the rise. Common cause of acquired brain injury is still trauma of the head. The survival rates even in the case of severe brain damage have increased due to early diagnostics and up to date multidisciplinary treatment. Timely and appropriate rehabilitation is an important aspect of treatment. Early rehabilitation aims at improving motor, cognitive and functional recovery while preventing or treating complications as soon as possible. In the article procedures of early neurorehabilitation, the importance of evaluation and goal setting as well as the involvement of a multidisciplinary rehabilitation team during treatment in Intensive Care Unit and later in wards are described. We put to light the difficulties of rehabilitation in different wards (neurological, neurosurgical, general) and we emphasise the importance of acute neurorehabilitation to perfect the functional outcome.

**Key words:** acute rehabilitation, neurorehabilitation, acquired brain injury

## **Bolesnici s ozljedom ili bolešću mozga – važnost rane rehabilitacije**

### **Sažetak**

Broj pacijenata s bolešću mozga, a posebno tumora, u porastu je. Uobičajen uzrok stečene ozljede mozga još uvijek je ozljeda glave. Čak i kod teških ozljeda mozga, povećano je preživljenje zbog rane dijagnostike i suvremenog multidisciplinarnog liječenja. Pravovremena i prikladna rehabilitacija važan je vid tretmana. Ranom rehabilitacijom nastoji se poboljšati motorni, kognitivni i funkcijski oporavak uz prevenciju ili liječenje komplikacija, što je prije moguće. U ovom radu opisane su procedure rane neurorehabilitacije, važnost evaluacije i postavljanja ciljeva, kao i uključenost multidisciplinarnog rehabilitacijskog tima tijekom liječenja u Jedinici intenzivnog liječenja, i kasnije na odjelima. Prikazujemo teškoće rehabilitacije u pojedinim odjelima (neurološkom, neurokirurškom, općem) i naglašavamo važnost rane rehabilitacije u usavršavanju funkcijskih ishoda

**Ključne riječi:** akutna rehabilitacija, neurorehabilitacija, stečena ozljeda mozga.

### **Introduction**

As most of the patients do not require multidisciplinary rehabilitation, hospitals mostly have only physiotherapists responsible for them. These patients recover quickly and are discharged home. On the other hand there are patients with severe disabilities who need complex rehabilitation started during the acute phase and not just regular physiotherapy. Such big group are patients with neurological deficits – acquired brain injury is the term used for any acquired insult to the brain (1). Acquired brain injury (ABI) can be caused by neurosurgical intervention, bleeding, trauma (common cause), ischemia (stroke), infection of the brain, post-cardiac arrest (hypoxic lesions), and neoplastic lesions.

Early neurological rehabilitation means starting rehabilitation of patients with ABI during the acute phase of the trauma or illness. Early onset of specific neurological rehabilitation interventions enhances medical improvement and social reintegration potential, as well as reduces complications and length of stay in hospitals (2). Early management of patients with brain damage requires a multidisciplinary rehabilitation approach which includes individuals with clinical skills in various fields. The program should be individually adjusted to the patient's lesion and his/her general condition.

## **Aim of Early Neurorehabilitation**

ABI leads to a variety of problems and different neurological symptoms such as disorders of consciousness, impaired motor control, sensory dysfunction, cognitive deficiency, and swallowing disturbances. The severity of symptoms depends on the extent and the area of brain injury. All these symptoms compromise essential activities of daily living. Some types of brain injury are only temporary whereas others result in permanent damage.

During acute hospitalization patients can have problems with respiratory care, including tracheostomy, problems with feeding and nutrition, including feeding tubes, swallowing problems including aspiration and also problems with bowel and bladder management. Many are dependent on intensive care treatment and mechanical ventilation and may be colonised with multi-drug resistant germs (3, 4).

A crucial part of acute neurorehabilitation is to prevent complications such as pressure ulcers, pulmonary and bladder infections, contractures and heterotopic ossifications. These complications have an important impact on the length of stay in hospital or can even be life threatening. They are very common in patients with neurological deficits, especially in patients with disorders of consciousness.

One of the problems during acute neurorehabilitation at neurology and neurosurgery wards is the equipment and rules of care because they are optimised to treat medically unstable patients rather than provide rehabilitation. Studies have stressed that patients recovering from brain injury should be treated in specialist neurorehabilitation units and that the placement of such patients in acute surgical or general wards is not acceptable (5). In our country (as well as in some other European countries) we don't have acute neurorehabilitation units so we start with the rehabilitation program at the earliest opportunity, usually in the intensive care unit. Early rehabilitation is provided by the rehabilitation team consisting of the occupational therapist working together with the physiotherapist, while the doctor for physical and rehabilitation medicine (PRM) is responsible for proper rehabilitation procedures in order to help the patient return to normal activities. The programme and procedures are individually prescribed by the PRM specialist after the evaluation of the patient. Other members of the team are included if this is necessary (psychologist, speech therapist, social worker).

## **Level of Consciousness**

Consciousness is the state of awareness of one's surrounding. The majority of patients with brain injury, especially after trauma, pass through a series of stages of consciousness. After being unconscious with eyes closed (coma), they progress to unconsciousness with eyes open (vegetative stage) and then to a stage of inconsistent, erratic responsiveness known as minimal conscious state (MCS). MCS is a condition of severely altered consciousness in which the person demonstrates minimal but definitive behavioural evidence of self or environmental awareness (6). The patient remains severely disabled but demonstrates sleep-wake cycles. It should be viewed as a part of the natural history of diffuse and multifocal severe brain injury.

To promote awakening in patients we use sensory stimulation as soon as possible. We start sensory stimulation the moment the patient is no longer sedated and his/her vital functions are stable. Until the patient's state improves we stimulate by using only one stimulus. Afterwards we can stimulate two systems at a time. Treatment session time differs and is distributed into shorter treatments throughout the day. An important part of the programme is the education of relatives and all the members of the team who work with the patient. With this programme we try to affect the awareness, wakefulness and attention in a positive way and prevent sensory deprivation. The stimulation enhances the rehabilitative potential of brain-injured patients. Most significant changes are caused by tactile and acoustic stimulation (7).

## **Procedures Used in Acute Neurorehabilitation**

The motor impairment and problems with walking are usually the most important deficits for patients. So we try to mobilise the patients who are otherwise bed-ridden. We use different equipment to help patients sit on their bed. To achieve standing we use the tilt-table, and the wheelchairs are used for sitting. Patients who are able to sit in the wheelchair can be driven out from the room, which has a positive effect on the patient's wellbeing. Even patients in a minimally conscious state can use the wheelchair provided it has been adapted to accommodate for passive sitting. Early mobilisation may prevent the well-known complications such as constipation, pressure sores, muscle wasting, orthostatic hypotension, and deep venous thrombosis (8).

To maintain full passive range of movement in the joints (if active movement is not possible) we choose the neuro-physiotherapeutic technique which is the best for the patients. Increased muscle tone is one of the problems which can

result in muscle shortening. With proper activity and training we try to prevent limb contractures. Sometimes we must use aggressive early intervention such as casting and splinting but we avoid using oral medications in the first six weeks because they have a negative effect on plasticity and they sedate the patients (1). In preventing spasticity we should be aware of all the factors which provoke the symptoms and signs of spasticity and prevent their effect on muscle tone (pain, pressure ulcers, urinary retention, constipation, infection, etc.).

Physical exercises are applied in a functional task orientated way with the aim to restore activities such as sitting and standing balance, transfers, gait, reaching, and grasping. Training of functional activities has greatest benefits among patients with moderate levels of disability and much less among those with severe levels of disability (9). If we want to select appropriate training strategies, we must carefully assess patients for their functional capacities. For assessing we use the Barthel index, Functional Independence Measure, de Morton Mobility Index (DEMMI), and the Berg Balance Scale. After assessing the patients we can choose between training focus on reduction of primary deficits (restitution of function) or training for promoting adapted strategies to achieve functional goals.

The intensity, frequency, and duration of the training to achieve changes in functional outcome are still unclear (10). A Cochrane review involving 14 trials showed that the number of trained repetition is significantly associated with improvement of walking distance, functional ambulation, and gait-related activity of daily living (11). The training in our hospital is performed six times per week; duration of the training depends on how well one is able to comprehend instructions and follow them. Typically the time is divided into shorter periods of training throughout the day. On the other hand we carefully choose the right procedure because some procedures are difficult to undertake due to fatigue, pain and/or lack of cooperation.

Occupational therapists help the patient to develop new ways of doing various daily tasks. In acute hospital we are limited to basic daily activities such as dressing, undressing, washing, and eating, use of wheelchairs and toilets. Our occupational therapists also give patients and their family members advice and instructions on how to improve the independence of the patient at their home. Occupational therapists together with respiratory physiotherapists (sometimes also with speech therapists) start with feeding as soon as possible. If the patient has problems with swallowing, we recommend PEG.

Some patients have extensive neurological deficits and disturbance of consciousness with poor cooperation. In these cases our activity is mainly focused on preventing complications. Patients receive respiratory physiotherapy regularly throughout the day, they are regularly turned over and put in proper positions, and physiotherapy is performed to prevent contractures. Passive verticalisation is used, while we put the patients in the wheelchair with a lift and electronic devices hence enabling joint movements.

### **Additional Treatment Techniques**

Recent discoveries about brain plasticity and how patients with brain injury reacquire lost behaviours by training have yielded promising new therapies (12). In the literature we can find different therapy treatment techniques which can be used in the process of neurorehabilitation (12). Some of them are suitable even during the time of acute hospitalization but are not used, because of the situation in wards. On the other hand, patients in the acute phase are often too ill to tolerate additional therapies. So these techniques are more appropriate when the patients are in neurorehabilitation units (12). Several studies have reported positive outcome with different approaches but the efficacy of these different therapy techniques remains controversial (13). Constrained induced movement (CIM) was first applied to motor deficit after stroke (14) and its efficacy has been demonstrated by a multisite randomized controlled trial (15). A very promising treatment concept over the last years is locomotor therapy by treadmill stimulation with partial body weight support (16). We must also mention robot aided neurorehabilitation, which is usually used in the chronic phase of disease, but can also be used in the subacute or even acute phase. Further studies are needed to evaluate the most beneficial time to introduce robotic therapies in neurorehabilitation treatment.

### **Discussion**

The length of stay in acute hospitals is short; patients should be discharged from the hospital as soon as possible. They stay in the hospital until the stabilization of clinical conditions. Unfortunately, patients with brain injury and severe neurological deficits can develop complications that significantly increase the risk of mortality and also lengthen hospital stay. Early rehabilitation aimed at mobilisation as soon as possible might be effective in preventing complications, and reducing the in-hospital infections and the hospital stay (17).

With multidisciplinary rehabilitation approach we improve swallowing and weaning from the tracheotomy tube, which can lead to faster decannulation and reduces respiratory complications (18). We know that survival after severe brain damage has improved so focus has shifted from survival to recovery. By starting rehabilitative intervention early we should try to decrease the neuromuscular weakness and deconditioning, which can be done with regular postural changes, passive multijoint mobilization, exercise progression and early mobilization. Very early rehabilitation, with an emphasis on mobilization, may contribute to improved outcome after stroke (19). Also after neurosurgical procedures we try to get patients out of bed within 24 hours after operation.

To stimulate awakening we can use multisensory stimulation, although literature evidence is sparse and not conclusive (20). A very important part for multisensory stimulation is environment where the stimulation is performed and usually the intensive care is not the right place. Despite the environment not being perfect we start with sensory stimulation as soon as the patient is without sedation but still not conscious.

Since patients with brain injury often experience permanent or temporary speech difficulties, they need specialized diagnostic procedures and therapy by a speech therapist. The diagnostic procedures should be done while the patient is still hospitalized in the acute setting and as soon as the patient's cooperation is insured. Also the therapy should be started in the acute phase and continued after discharge from the hospital. In the time of acute hospitalization in our hospital the patients with communicative disorders are seen by the speech therapist but usually at the end of the hospitalisation.

Patients' ability to think, process information and solve problems is usually affected after brain injury. Mood changes, which are also present very often after brain injury, can be very distressing. Agitation, irritability, lack of awareness, disinhibition, emotional lability, apathy, depression, and anxiety have important negative effects on rehabilitation procedures. Neurophysiologists are included, because the patients need early neuropsychological treatment or evaluation of their cognitive deficits at least. But we have problems with early psychological treatment due to the lack of psychologists employed in hospitals. Bartolo et al. find limited involvement of health professionals other than physiotherapists during intensive care treatment (17). Especially speech therapists and psychologists were included in only a few cases, although a recent study showed that bedside psychological sessions reduce risk of developing post-traumatic stress disorder (21).

Assessment is of major importance in rehabilitation medicine in terms of defining goals and for allowing evaluation of recovery and efficacy of therapy. Disability scales are broadly used for assessing functional recovery and designing definitive goals for rehabilitation (22). A valid assessment of neurological early rehabilitation patients is difficult (23). Sensitivity of the Barthel index (BI) is low when assessing severely impaired neurological early rehabilitation patients (24). The so called Early Rehabilitation Barthel Index (ERBI) has limitations because it does not allow evaluation of wakefulness and cognitive abilities (25). On the other hand some well-known well-established scales like the Glasgow Coma Scale measure wakefulness but do not comprise activities of daily living or cognitive items (22). In our institution we use mostly the BI and Functional Independence Measure, usually before we start with our procedures and at discharge from the hospital. The evaluation is not regular and we still haven't decided which scale is the best in the field of early rehabilitation.

## **Conclusion**

With proper early rehabilitation we enable the patients to become more independent, we can prevent complications and ensure a better starting position for further rehabilitation. Integrating neurorehabilitation into intensive care treatment is possible and can lead to improved outcomes in this patient population. Neurorehabilitation units are essential because the management of patients with acquired brain injury in this unit reduces the mortality and improves functional outcome.

A lot of effort is still needed for these units to form. Until such a time part of the rehabilitation process is done in the ward where the patient is located and our procedures are adapted to the environment and capabilities that are available there. We need to strive to ensure the continuation of rehabilitation in institutions that are specialized for doing so as soon as possible. By doing this we ensure the continuity of rehabilitation while enabling an interdisciplinary approach to rehabilitation

## **Izjava o sukobu interesa**

Autori izjavljuju da nemaju sukob interesa.



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