Prevention, treatment and outcome of secondary complications during the rehabilitation of patients with severe brain injury

Thesis

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**Introduction**

Different impairments caused by accident or disease can make transitory or permanent problems in human functions. Treatments of impairments and improvement of different functions are performed during rehabilitation, whether they were caused by primary impairment or secondary complications of the functional deficits.

Recovery from traumatic brain injury is determined by the primary injury and by the secondary complications and also these determines possibility of available maximal functional abilities during rehabilitation and the quality of life afterwards for the patients and their family. That is why during medical treatment the prevention of secondary complications is as important as the primary prevention is. Following the acute treatment patients with severe brain injury most of the secondary complications are recognised and treated during the rehabilitation.

Mortality rate is about 20% in centers specialised in the treatment of severe brain-injured patients, but more than 50% in small general hospital.

Patients with severe brain injury are highly threatened from secondary complications. Different treatment activities can be necessary to perform on patients at the intensive care unit after accident or impairment: tracheotomy, respiratory treatment, intracranial pressure monitoring, nutritional therapy, gastrotomy, surgical activities. Long term (weeks or months) treatment of patients at intensive care unit, prevention of life threatening complications exists with immobilization.

Prevention the symptoms of immobilisation syndrome have to start at the acute care unit. Collaboration between rehabilitation professionals and the intensive care staff is extremely important, because treatment of complications occurs at the rehabilitation unit, but activities to prevent complications have to start at acute care unit. Early admission of patients with fewer complications promotes easier and more successful rehabilitation. Early admission requires rehabilitation specialists and sufficient financial background for the safe treatment of such severely ill patients. Length of stay at hospitals and number of complications can be reduced with early intensive rehabilitation treatment.
Aim of the study

1. Determination of the most important secondary complications after severe brain injury.
3. Observation of the effects of secondary complications on the rehabilitation process.
5. Description of the results of prevention activities for secondary complications.

Patients and methods

In the Brain Injury Rehabilitation unit of National Institute for Medical Rehabilitation in Hungary 301 patients were treated in 2004. From these 166 patients suffered severe traumatic brain injury.

Data of patients with traumatic brain injury were collected retrospectively with the help of a data set constructed by me following the recommendations of American Congress of Rehabilitation Medicine. Traumatic brain injury, broadly defined as brain injury due to externally inflicted trauma, may result in significant impairment of an individual’s physical, cognitive, and psychosocial functioning.

Severe brain injury results principally from accidents, more than 2/3 of the cases, and the remaining 1/3 are anoxic, metabolic origin or causes stroke, brain tumors. Patients with nontraumatic brain injuries are commonly treated together with traumatic cases, but the outcome is highly different. Classification of the severity of brain injury is based on the patient’s GCS (Glasgow Come Scale) score according to worldwide practice.

The mean age of the patients was 33 (8-83) years. The majority of patients suffered traumatic brain injury in traffic accidents (125/166), while the rest of the patients suffered from falls, or acts of violence. Sixty four patients were admitted directly from an intensive care unit, 18 from a second hospital ward (traumatology, neurosurgery or neurology) and the rest of the patients were treated in several different units before they were admitted for rehabilitation.

The time elapsed between the time of injury and the rehabilitation admission was 50 days (21 - 177). At the time of admission 27 patients were in a vegetative state, 38 patients in a minimal conscious state, and 101 patients had already regained consciousness. 83 patients were hemi paretic, 54 presented tetra paresis, and 1 para paresis, but 2 patients were not paretic.
Results

The length of stay (LOS) in our unit was on average 53 (8-144) days, yet 43 patients had to be readmitted for further therapy after adaptation period at home, so with these the LOS was 75 (8-289) days. 142 patients were discharged to their home, while 20 patients (8%) had to be sent back to the acute ward treatment due to complications (Unplanned interruption to a patient’s rehabilitation program).

46 patients were admitted with tracheostomy and during our treatment in 33 cases decannulation was possible after fiberoscopic examination. Tracheastenosis were observed on an average 3 months after trauma and it had to be treated in 7 cases.

59 patients were admitted with urinary catheters and they were treated according to our guideline. In 56 cases the removal of the urinary catheter was successful.

57 patients were admitted with percutaneous endoscopic gastrostomy (PEG), and in 3 cases PEG was placed in our unit. Twenty percent of severe brain injured patients were malnutritioned at the time of admission, and clinical nutrition required in 25%. Rehabilitation of 107 patients was complicated from 166 cases. Complications were observed at the time of admission: 78 contractures, 58 pressure sores, and 28 heterotopic ossifications. The most serious complications were treated during rehabilitation phase: 23 pulmonary infections, 19 urine infections, 4 septicaemias, 6 severe malnutrition, 2 urethra stenosis, 3 urolithiasis, 1 orchitis, 2 cornea ulcers, and 2 deep vein thrombosis. Treatment of contractures was cast redression in 17 cases, and orthopaedic surgery in 44 cases. Plastic surgery was performed 2 cases for pressure sores. Intrathecal baclofen pump was implanted in one case, and botulinum toxin A was used in 5 cases for reducing spasticity. At the time of admission Barthel Index score of patients was 20, at discharge 56, and one year after trauma 70.

142 patients were discharged to their home, while 20 patients had to be sent back to the acute ward treatment for complications, and 4 patients were sent to nursing home.

Discussion

Recovery from severe brain injury, the level of ability to perform activities of daily living, and readaptation into community usually is influenced by several factors. The most important ones are: primary neurological impairment, secondary complications, general condition of the patient, age and social-economical position. Evaluation of the patients’ functional state and
secondary complications is necessary in order to plan appropriate rehabilitation services. The most frequent complications in severe brain injury observed at the time of admission were contractures. Significant contractures can cause difficulties in functional recovery or even nursing activities, in such cases intervention is necessary. If nursing activities or mobilization is not possible due to contractures, operative treatment is required immediately. This will then provide the opportunity positioned and fed. If the management of the complications is not successful, patients’ life could be threatened. Achilles tendon lengthening was the most frequent operation on the lower limb we performed to solve mobilization problems caused by equinus contracture. Length of stay at the rehabilitation unit was one month longer in operative equinus contracture cases and two months longer in operative knee contractures cases.

Talectomy operation was performed to correct the most serious foot deformities mainly as a secondary procedure. During 1995-2004 we made talectomy operations on 9 limbs of 5 adult patients successfully. In the last century this operation method was only used for correction of children’s foot deformities.

Wrist arthrodesis was used to correct severe wrist and hand deformities in the last 8 years on 8 limbs of 7 patients. The main indications for this operation were to improve hand function or to provide hygiene of the hand, but with the stabilization of the wrist improvement was found in independent functioning and quality of life.

Heterotopic ossification is one of the most serious complications causing limitation in function. We had experience from operations performed on 31 patients (34 hips, 5 knees, 7 elbows) during 1990-2000 years. Operation is performed in order to improve function in patients one or one and a half year after the accident, who have good muscle function and appropriate compliance.

Spasticity is one of the most important factors in development of contractures. We introduced botulinum A toxin and intrathecal baclofen treatment in spasticity management.

Larynx and trachea examination with fiberoscopy is obligatory before trachea decannulation of severely brain-injured patients during rehabilitation.

We found that PEG is a safe method for clinical nutrition of severe brain-injured patients who require assisted feeding for a longer than 3 weeks. As a consequence of serious malnutrition, patients with severe brain injury show a higher incidence of complications and the length of stay in the rehabilitation unit was longer.
In patients admitted for rehabilitation with a urine catheter removal procedure has to be started as soon as possible according to an appropriate protocol in order to avoid complications. We introduced a bed-side bladder scan for measuring of residuum.

The immobilized severe brain-injured patients first have to reach a state the possibility of lying prone and being positioned can be performed because healing of pressure sores can only be achieved in these conditions.

Our experience suggest that skin or mesh graft is not suitable for treatment of pressure sores on bony surfaces (sacrum, trochanter major femoris) only the musculo-cutaneous flap technique.

We adopted internationally accepted scales (Barthel Index, FIM, GOS) to monitor our activities and developed new quality indicators and published them. We prepared protocols for performing the most important activities: Urine catheter removal protocol, PEG treatment protocol. These were published to help other centres to avoid complications.

The number and severity of complications we treated in our unit was higher than usual, because we admit the most serious cases from all over the country. A multidisciplinary team consisting of colleagues with special expertise in orthopaedics, endoscopy, bronchoscopy plastic and septic surgery is necessary to manage such complex patient population with severe disease.

In addition, during rehabilitation the involvement of a multidisciplinary team specialised in different functional deficits (physical-, cognitive-, communicational-, psycho-social impairments) is necessary.

Early and direct admission of patients seems to be optimal from the neurointensive unit into the rehabilitation centrum (early intensive rehabilitation), because the possibility of development secondary complications in this case is reduced.

The functional outcome was worse in the complicated cases during the same rehabilitation period. The length of stay in the rehabilitation unit was much longer at complicated cases.

Activities to prevent complications have to start in acute care unit. Consultation between rehabilitation and acute care professionals is necessary in order to combine the treatment experiences, elaborate new methods to reach maximal functional recovery of patients with brain injury.
1. This is the first investigation in this country with clinical data which identified secondary complications of severe brain injury and evaluated new treatment methods.
2. It was documented that the rehabilitation results of patients with brain injury is determined by the primary impairments and the secondary complications.
3. The most frequent complications during rehabilitation in severe brain injury are: contractures (47%), pressure sores (35%), heterotopic ossification (17%), respiratory (14%) and urinary tract infections (11%), malnutrition (20%) and immobilization.
4. Symptoms, definition and prevention methods of immobilization syndrome were described for the first time in Hungarian literature.
5. New operative methods were developed on adult patients with severe brain injury to correct foot deformities and to improve walking ability: partial transfer of tibialis anterior muscle tendon, talectomy.
6. Operative wrist arthrodesis was a new surgical method we developed to improve hand function or hygienic possibilities of patients with brain injury.
7. We developed an operative method for the treatment of heterotopic ossification, one of the most serious rehabilitation problem, and first published it on Hungary.
8. Trachea decanulation was performed according to our protocol and in complicated cases management of trachea stricture was treated with T-stent during rehabilitation.
9. It was documented that the inpatients rehabilitation program of brain injured patients with severe malnutrition is longer, the number of detected and treated complications are higher, and functional improvement is slower.
10. Bed-side bladder scan was introduced in Hungary for the first time and the number of catheterization during a year was reduced by 150 in our unit.
11. The dissertation presented that pressure sores treatment had to fit into the rehabilitation process. Mobilization which facilitates the recovery of patients with severe brain injury is more important than definitive plastic surgery of pressure score with requires 3-4 weeks immobility.
12. Spasticity is one of major facilitating agent development contractures. In cases of severe spasticity for hemi- or tetraparetic patients intrathecal baclofen therapy could be the possible method for reducing spasticity. Baclofen pump implantation was indicated in patients with spasticity of cerebral origin. Management of these patients took place in our unit.
13. Botulinum A toxin therapy for the local treatment of spasticity on upper limb of traumatic brain injured patients was first put into practice and published.

14. Unplanned interruption to a patient’s rehabilitation program as a rehabilitation quality indicator was described, examined and first published in Hungary.
List of publications


