

## THE COURSE OF RESTITUTION OF BRAIN INJURY IN THE EARLY AND LATE STAGES AND THE REHABILITATION MEASURES<sup>1</sup>

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**ABSTRACT.** Cerebral concussion needs aftercare but no rehabilitation. The rehabilitation of the cerebral contusion and of the acute brainstem syndromes must be started immediately after the accident. The aim of the preparatory phase has to be to create optimal conditions for the further active rehabilitation. The organization of a rehabilitation centre requires the placing of patients in a special therapeutic group with a specific program. Each patient has an individual program within the daily schedule of the group. The course of the rehabilitation is based on the rule of starting with the training of the remaining cerebral functions. The therapeutic group follows the rules of the group dynamic.

From the symptomatology of the acute stage of a brain injury no conclusion can be drawn as to its course and prognosis. This concerns especially the so-called cerebral contusion. But even in slight cases of a traumatic brain lesion—the concussion syndrome—it cannot be decided whether a severe secondary brain damage will be followed by a complication. This may also be one of the reasons why no better classification of the clinical symptom groups of brain injuries has been found up to now. In practice, therefore, the traditional division into: cerebral concussion, cerebral contusion, and cerebral compression, are still in use. The term cerebral compression, *compressio cerebri* has, however, no clinical concomitants and should be replaced by the designation acute secondary traumatic brainstem syndrome.

Since no morphological abnormality of a concussion syndrome can be found and all the symptoms are presumed to be fully reversible, the treatment, *vis-à-vis* the rehabilitation, has to be directed only to a stabilization of the disturbed vegetative functions and to the resocialization of

the patient. However, it is necessary to treat a patient with a concussion syndrome as a severely injured person, otherwise neurotic reactions can arise. The symptomatology of the cerebral contusion depends on the localization and the size of the damaged brain. All cases of cerebral contusion need an active rehabilitation with an individual programme.

Acute traumatic brainstem lesions can be of primary or secondary origin. Whereas in the investigations of Peters (10), Mayer (9) and Jellingner (8) patients with an acute primary brainstem lesion die in nearly all cases within a very short time, the acute secondary traumatic brainstem lesion shows a classic development in its clinical symptoms which can be precisely diagnosed. In all cases the origin of an acute secondary traumatic brainstem lesion is a complication of the brain injury, such as a brain edema or an intracranial haematoma. Both of these complications cause an increase of the intracranial volume followed by a mass movement and finally by an incarceration of the brainstem. By this mechanical procedure a transtentorial herniation (uncal or medial) is produced, continuation of the intracranial increased pressure is followed by a foraminal herniation. As a consequence of the transtentorial herniation the acute midbrain syndrome develops, while after the foraminal herniation the bulbar brain syndrome can be observed. The early discovery of an acute secondary midbrain syndrome is an aid to successful treatment. Thus, severe secondary brain damage and in some cases even the death of the patient can be prevented.

The acute secondary midbrain syndrome develops in four different phases. Its characteristic symptoms are to be found in a disturbance of consciousness and of reaction to the surroundings,

<sup>1</sup> Read at the International Symposium on Rehabilitation in Head Injury, Göteborg 1971. Problem Commission of Physical Medicine and Rehabilitation of the World Federation of Neurology.

in typical symptoms of the oculomotoric system and of the motoricity of face and body as well as in a disinhibition of the vegetative system. The main symptoms of the acute secondary traumatic bulbar brain syndrome are caused by the breakdown of the motoric and vegetative regulation centres. The majority of the patients with an acute bulbar brain syndrome die after 20–30 minutes or else the status of a breakdown of the cerebral functions appears—due to modern reanimation techniques—which can be followed by the Coma dépassée (status of a breakdown of the cerebral functions = dissociated death, brain death).

In 30% of patients, the acute midbrain syndrome disappears. The remission can start in each phase in the same way that the brainstem syndrome has developed. In cases of a remission of an acute bulbar brain syndrome, first the full state of an acute midbrain syndrome can be observed.

The acute midbrain syndrome can pass over to a chronic decerebration stage which we call the apallic syndrome.

#### REHABILITATION METHODS

Up to the present day, 40% of patients with an apallic syndrome die; 50% of the remainder show a satisfying remission, partly a full restitution. The course of the remission of an apallic syndrome goes through certain typical phases. Each case of a primary and a secondary traumatic brain lesion (cerebral concussion is excluded) needs an intensive rehabilitation treatment. The rehabilitation has to be started without regard to a possible favourable prognosis, with the aim of obtaining an early and complete restitution. If unconsciousness of a brain-injured patient lasts more than 6 hours and especially if symptoms of an acute midbrain syndrome develop, the transfer of this patient to the intensive care unit must be arranged after investigations to exclude an intracranial haematoma.

The rehabilitation of a brain-injured patient, especially of one with an acute midbrain syndrome, must be started even in the acute stage. The aim of all actions in this *preparatory phase* is to create optimal conditions for further active rehabilitation. The most common risks in the subacute phase of a severe brain injury, and here again especially of a midbrain syndrome, are decubital ulceration, contraction of the joints,

periarticular ossifications as well as damage of peripheral nerves. Special measures for preventing the above-mentioned complications are additional hypercaloric alimentation with 5 to 7 thousand calories daily, the use of tonus-regulating reflexes and the application of various medicaments such as antispastic or psychostimulating drugs. By use of tonus-regulating reflexes—which of course cannot be used in the acute phase—active movements of the decerebrated patient can be produced and the degree of the increased tonus of the different muscle groups can be altered. As a consequence of this treatment, the reticular formation of the brainstem is stimulated and consequently the vigilance of an apallic patient can be increased. By altering the position of the head as well as of the body, joint contractions and periarticular ossifications can be prevented or diminished. On the other hand, decubital ulcerations, cystitis, painful contractions of the joints, etc. increase the tendency of emergency reaction, which produces an increase in the whole metabolism and a decrease in resistance.

The preparatory measures also concern head-injured patients without a midbrain syndrome—especially those suffering from a frontal lobe lesion—if they have to stay for a longer time on the emergency ward or at an intensive care unit.

The rehabilitation of head-injured patients has to be effected at a special rehabilitation centre. This fact has been pointed out by Höök (7), Gerstenbrand (4) and others.

The active rehabilitation should be divided into the following phases: the activation phase at the first contact, the mobilization phase with stabilization, the integration phase, the resocialization phase and the phase of after care. For this purpose our rehabilitation unit is divided into two groups: the mobilization group and the special therapeutic group (Leistungsgruppe). A rehabilitation unit should consist of 18 to 20 patients of both sexes. Patients live in a community department, complete with sleeping, living, working and gymnastics rooms, as in a large family. They are cared for by a staff which consists of specially trained medical and nursing personnel. The medical staff is a team of three neuropsychiatrists and consulting specialists. The ward staff includes a logopedist, one physiotherapist, one social worker, one occupational therapist, a professional adviser and a provisioner.

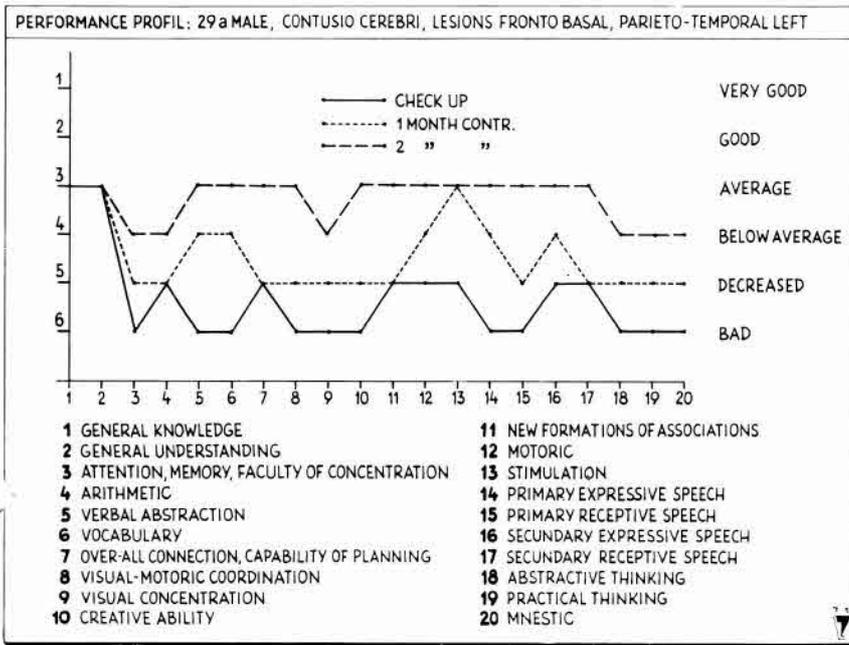


Fig. 1. Performance profile: Contusio cerebri, lesions fronto-basal bilateral, parietotemporal left.

After transfer, every new patient, irrespective of the severity of the post-traumatic sequelae, enters the mobilization group, which consists of 4 to 6 patients and is separated from the second group but in close contact with the other patients. At the time of transfer the metabolism of the patient has to be stabilized, feeding by mouth should be possible and the tracheostoma should be closed.

New patients are evaluated for brain damage by clinical examination and other diagnostic procedures, such as EEG, pneumoencephalography, electrical examination and so on. Finally a battery of psychological tests are carried out to obtain a "performance profile". This profile demonstrates various abilities such as general knowledge, comprehension, and memory as well as arithmetic ability, visual concentration, combination ability, and expressive and perceptive speech (Fig. 1). In cases of apallic syndrome in full state it is of course not possible to complete the above-mentioned examinations or to elaborate a performance profile.

Based on the results of all the examinations, an individual rehabilitation programme is drawn up for every patient at a conference of the whole

staff. The programme takes into consideration the individual social and professional status. The training programme is based on the rule first to train the undamaged brain functions and only later to start with the training of compensative mechanisms.

After the examination period, the mobilization of the brain-injured patient begins. Every patient including those with an apallic syndrome is kept in continuous contact with patients of the other group to encourage inter-personal relationships.

In severe cases, especially in those with an apallic syndrome primary the measures of the preparatory phase, i.e. tonus regulating reflexes etc., will be continued. Personal contact has to be encouraged.

In the apallic syndrome the first direct contact is possible in the Klüver-Bucy-phase. Patients are trained to do more coordinated acts by integrating oral and grasping patterns such as bringing an object to the mouth. In this way it can be learned how to handle a spoon and other implements and to do more complicated actions. In this phase conditional reflexes are used. The first vocal expression in the form of primitive murmuring permits a start to be made in logopaedic

Table I. Results of treatment of the rehabilitation center for brain-injured, University of Vienna 1964-1968

From: F. Gerstenbrand "Rehabilitation of the Head-injured". In *The Late Effects of Head Injury* (ed. A. E. Walker, W. F. Caveness & McD. Critchley), pp. 340-350. C. C. Thomas, Springfield, Ill., 1969

	Moderately severe injury	Severe injury	Traumatic apallic syndrome	Total
No change in profession	35	21	6	62
Change of working place	3	6	3	12
Change in profession	2	12	5	19
Unemployed	3	1	—	4
Limited pension	2	7	3	12
Permanent pension	—	8	2	10
Reconvalescents	6	9	2	17
Incomplete treatment	7	8	4	19
Children	1	5	4	10
Died	1	1	3	5
Total	60	78	32	170 <sup>a</sup>

<sup>a</sup> Includes 158 male and 12 female patients.

therapy. At the same time, in the Klüver-Bucy-phase of the physiotherapeutic measures, active movements can be started.

During the mobilization phase, current controls of the metabolism, electrolytes and so on, as well as of EEG and EMG, are necessary. The tests for the performance profile have to be carried out every 2 to 4 weeks, later on every 2 to 4 months. Of course neurological and psychiatric examinations must also be made. All these controls must be continued during the whole rehabilitation treatment.

As soon as the somatic condition permits, the patient is placed in the special therapeutic group (Leistungsgruppe). At that time the injured must be able to move, alone or with support, and to feed themselves. The group consists of 12 to 15 men and women. In the special therapeutic group the basic principles of group therapy are used and a therapeutical community is established. There is a fixed daily programme with assigned periods for common training, working, individual training, etc.

Based on the neurological disturbances and on professional interests, subgroups are organized.

In the same way subgroups for music therapy and psychodrama may be established.

Due to the differences in the remission stages and in the neurological disturbances of each patient there is a "grading of achievement" (Leistungsgefälle) in the therapeutic community. This "ordering of achievement" activates compensation tendencies and motivation, causing patients to help each other. The gait-disturbed will be assisted by the motor-semirehabilitated or by one who has an aphasia. By this system the number of the paramedical persons is increased essentially. Some of the more advanced patients are motivated to help in the care of the severest cases of the mobilization group, for example to feed an apallic patient.

Productivity is stimulated by group dynamic each patient wants to be equal to the others. This we call performance appeal (Leistungsanforderung). Performance differences provide incentive and oblige the more disabled to increase their efforts in order to attain the standards set by their fellow patients. Besides individual performance there is a "collective compulsion". A dynamic field tension exists between doctors and nurses, especially the chief nurse. In the centre are the patients, both as individuals and as a group. In this system the doctor acts in the function of a father, the chief nurse in the function of the mother.

While the aim of the stabilization phase of the rehabilitation programme was to train, stabilize and augment the undamaged brain functions the tendency of the *integration phase* is to repair the partly disturbed or damaged functions and to build up compensative mechanisms. The performance profile indicates the direction of the training. If surgical procedures are necessary to eliminate or improve orthopaedic problems (peri-articular ossifications, etc.) they should be done before the integration phase.

Another important aspect of this phase is to include the relatives of patients in the rehabilitation programme. This can be achieved by bifocal group therapy. Permanent contact with relatives permits an indirect influence on the patient. Sometimes the first neurotic reactions appear in this phase and psychotherapeutic methods are to be introduced.

In the resocialization phase, contact with the patient's profession should be initiated. The social

worker has to discuss the possibilities of a return to the previous profession, of changing to another job, or of accepting invalidity.

The patient may be discharged from the rehabilitation centre when the clinical symptoms of brain injury have disappeared or become stabilized. Almost any stabilized defect tends to improve spontaneously, principally as the result of an adaptation to the environment. After discharge, regular ambulant controls are necessary in every case. Patients with severe brain damage are often best handled as outpatients for some time. Family problems may be alleviated by a night clinic. In professional life, social workers support the injured. Contact with the rehabilitation unit extends over several years with most of the patients.

#### *Results of the Rehabilitation of the Neurological Clinic, Vienna*

At the Neurological University Clinic of Vienna we have seven years' experience with a special rehabilitation unit for head-injured. 284 patients have passed this station, a third of them with severest traumatic lesions, most of these with an apallic syndrome. Of these patients 70% were transferred from an intensive care unit. About 50% of our patients could be kept under control as from the acute stage.

Our research unit consists of 18 beds, 14 for men, 4 for women. Sometimes even children are among the patients. The organization of the unit is based on the principles which are discussed above. There is a fixed programme for daily activities and for each patient an individual schedule is elaborated.

The main idea in the training for regaining or compensating the disturbed brain functions is to demand as much as possible of each patient without overtaxing his abilities. Asking too much from a patient will frustrate him, while demanding too little will leave him with his disabilities and possibly lead to a regression.

The Table I shows the results of the rehabilitation of 170 patients during a period of 4 years. As can be seen even in cases with severe brain

damage favourable results can be obtained. It is remarkable that of the 32 patients with a traumatic syndrome, 14 were able to work again, 6 of them without change of profession. This experience confirms the objective: Rehabilitation in every case with full intensity.

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*Key words:* Brain concussion, contusion, acute midbrain syndrome, acute bulbar brain syndrome, apallic syndrome, therapeutic community, performance profile

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