Rehabilitation of the Head-injured

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EHABILITATION means the recovery from or the compensation of a somatic or a psychic damage which affects the total personality. Disorders in the personality can arise as the result of psychic reactions to the damage or as the result of localized injury to certain brain regions or of the general effect on the personality of diffuse brain impairment. Psychic maladjustment to injury can fix somatic sequelae and induce so-called functional disorders or psychic symptoms, or it can delay the spontancous regression. The appropriateness of the patient's reaction to his somatic disorder predicates the time and intensity of rehabilitation. That is the reason why psychotherapy is used in rehabilitation, especially in cases with brain injuries.

The symptomatology caused by brain injury both in the acute and chronic stages depends on (1) the localization of the brain lesion, (2) the reaction to this lesion of the brain as a whole, and (3) the personality reaction of the patient to the disorder and brain function.

1. The clinical severity of the brain lesion depends on the location of affected brain and on the kind of brain damage. An injury may cause single or multiple lesions or diffuse brain damage. Depending upon the location of the injured brain, certain clinical symptoms are produced, for instance, focal symptoms (i.e. motor loss, speech disorder, frontal lobe symptoms) or diffuse brain disorders leading to decerebration, which is the clinical expression of the apallic syndrome that generally results from diffuse or several severe lesions. 06

The symptomatology of brain injuries often does not conform to morphological lesions. So the conception "brain contusion" (contusio ccrebri) is used for various kinds of traumatic syndromes irrespective of the area and extent of the injured brain tissue. Attempts to find a better clinical designation for the acute sequelae of brain injury have not been successful. The classification into brain lesions (Hirnschüden) I-IV suggested by Tönnis25 was not accepted. Therefore, the old designations "commotio cerebri" and "contusio cerebri" are still in use. The term "compressio cerebri" has no clinical concomitants and should be replaced by the symptomatology of brain stem incarceration. From the clinical point of view three acute traumatic syndrome groups can bc distinguished:

Commotio cerebri. Loss of consciousness is the leading symptom, combined with amnesia and vegetative disorders. Because no morphological abnormality can be found, all the symptoms are presumed to be fully reversible. But the pathophysiology of the cerebral commotio is not yet completely understood. Sometimes frontal lobe lesions are falsely diagnosed as severe cerebral

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commotio as the result of an inadequate examination.

Contusio cerebri. Because of the numerous primary and secondary lesions of the brain, the symptomatology can be highly variable. The clinical diagnosis of the cerebral contusion does not imply localization, the nature of the traumatic lesion, or its expected course.

Acute brain stem syndromes. At the present time, the majority of traumatic brain stem syndromes are considered due to secondary damages.13,17,19 Patients with a primary traumatic lesion of the brain stem die within a very short time, usually at the 'ace of accident. The secondary traumatic brain stem lesions are caused by transtentorial as well as foraminal herniation as the result of mass movement of the cerebrum (posttraumatic brain edema, intracranial hematoma). With continuous clinical monitoring, the symptoms of brain stem compression can be recognized because of their typical development.6,11,17,20 Clinically they may be divided into the acute midbrain and the acute bulbar syndrome. This corresponds to the midbrain-upper pons stage and the medullary stage of McNealy and Plum.18 The symptomatology of these syndromes is very uniform. The main symptoms of the midbrain syndrome besides deep coma are extensor spasms of the body and the limbs (decerebrate rigidity), divergent position of the bulbi, sometimes combined with skew viation, pyramidal signs, dissociated vestibulo-ocular reflexes, inhibited vegetative reactions such as tachypnea and tachycardia (Fig. 31-1). In the acute bulbar stage the extensor spasms and the pyramidal signs have disappeared, and a breakdown of the vegetative regulatory centers is shown by respiratory arrest and severe cardiac and circulatory disturbances. Both states are reversible. The acute brain stem syndromes may pass to a chronic decerebration state, the so-called apallic syndrome.6,14

2. The symptomatology of traumatic brain damage is also influenced by the reactions of the total brain to the local or



FIGURE 31–1. Acute midbrain syndrome, full state, transtentorial herniation by epidural hematoma. Deep coma, extensor spasms.

diffuse lesions. The effect may be compounded if the injury involves a juvenile or a brain previously damaged by alcoholism, intoxication, vascular disease, et cetera. Reaction of the brain to local or diffuse damage may produce the clinical picture of an exogenic reaction type (Bonhoeffer's *exogener Reaktionstyp*) with variations. If the compounded brain damage reaches a certain point, the higher brain functions break down and are reconstituted and stabilized on a lower level. As a transient syndrome, a Korsakoff-Klüver-Bucy syndrome—or, in the case of complete dysfunction of the cerebrum, an apallic syndrome—can arise.

3. Every case of brain damage is combined with a regressive reaction of the whole personality. This regressive tendency may be considered as a biological attempt to immobilize the patient for a better recovery, but an incorrectly directed regression can disturb the course of recovery and become a psychopathological symptom.

As demonstrated, brain injuries can produce manifold neuropsychiatric symptom complexes in the acute and in the early recovering state. They are classified into two groups: (1) syndromes due to a focal lesion accompanied by different contributing reactions of the total cerebrum and (2) symptom-complexes caused by the reaction of the total brain functions to the traumatic damage. Accordingly, the clinical symptomatology of the first group falls into that of contusio cerebri, acute midbrain syndrome, et cetera. The clinical syndromes of the second group are fairly well summarized in the posttraumatic psychoses or in the various kinds of so-called transient syndrome

(Wieck's *Durchgangs-Syndrom*). This again shows the difficulty in classifying traumatic brain lesions and the posttraumatic sequelae. But a clear diagnostic classification is the foundation for planned rehabilitation.

REHABILITATION METHODS

Preparatory Phase

Every patient with a head injury should have a neurological examination immediately after admission to the emergency ward so that the severity of the damage may be assessed. In the acute stage there is no possibility of determining accurately the damage done by anatomic lesions, nor can the effects of future complications (brain edema, hematoma) be estimated. By means of neurological examination, assisted by electroencephalograms, echograms, et cetera, brain stem disturbances must be watched for signs of tentorial or foraminal herniation in order to initiate special examinations to exclude intracranial hematoma. Patients with unconsciousness lasting longer than 12 hours should be transferred to an intensive treatment ward.

In every case of brain injury, rehabilitation should be started immediately after the acute phase, regardless of the degree of severity. The aim of this is to bring the patient to an optimal somatic condition.

Generally, it is stated that every patient with a functional loss due to traumatic brain damage should have rehabilitation treatment. Certainly every patient with cerebral contusion of any severity and with various symptoms—as well as patients with brain stem lesions, especially those with an apallic syndrome—needs active rehabilitation.

Only certain cases of cerebral commotio need treatment, but this cannot be called rehabilitation. As mentioned before, cerebral commotio has recognizable pathomorphological traces.²⁷ The main aim of aftertreatment is the elimination of neurotic reactions. Doubtless great mistakes are still being made in such treatment. The fact of the accident and the presentiment of death instigated by the unconsciousness are very traumatizing. Mobilization started too soon may induce vegetative disturbances that will grow into a neurotic fixation.

In the preparatory phase, the most important measures for the unconscious patient are passive movements of limbs and body. However, attention must also be paid to the position of the body, head, and limbs. Both of these measures prevent contractions and periarticular adhesions as well as trophic ulcers and lessen atrophies of the muscles due to disuse. In case of a midbrain syndrome, the different postural and labyrinthine reflexes (Magnus-de Kleyn) in the remission state may be elicited to induce movements of the limbs and the body as well as to change the muscular tonus. By altering the position of the head, the posture of the body and the limbs is changed. Turning the head to one side extends the extremities on that side and flexes the extremities of the other side (Fig. 31-2). In the same



FIGURE 31-2. Acute midbrain syndrome, transition state to an apallic syndrome. Turning the head to right elicited extension of the right limb and a flexion of the left limb.

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way, movements of body and limbs may be induced by the neck-bending reflex and the postural and labyrinthine reflexes. If the position of the head is not watched carefully, fixation in a postural pattern may take place (freezing in the postural reflex is illustrated in Fig. 31–3). On the other side, indirect movements elicited by the postural reflexes cause an activation of the cortical functions in the way of the ascending reticular system. Dr. and Mrs. Bobath¹ have worked out treatment methods, utiliz-



FIGURE 31-3. Traumatic apallic syndrome, full state. Coma vigil, fixation of the upper limbs and head position according to the posture (asymmetric tonic neck reflex).

ing tonus-regulating reflexes which have been successfully used in cerebrally damaged children for a long time and are also applicable to cases of the apallic syndrome.

In the preparatory state, during intensive treatment, it is necessary to avoid peripheral stimulation such as irritation of the trachea by frequent cleansing techniques or the irritation of the urethra by catheterization. In patients with brain stem lesions every stimulation is maximally transferred to the reticular system of the brain stem as well as the spinal cord, with the result that the muscular tonus is increased, and the postural or escape reflexes are elicited. In this way, intensive passive movements of the extremities or a vibration massage can produce an enhancement of tonus.

Antispastic drugs may be used to diminish the muscular tonus (Lisidonil[®], Norflex[®], Valium[®]).

Another measure taken during the preparatory phase is the treatment and the avoidance of psychic complications which may arise from lesions in certain parts of the cerebrum, for instance, in the frontal lobe.

A special problem is caused by the traumatic frontobasal syndrome¹⁵ and the frontoconvexity syndrome. The frontobasal syndrome consists of emotional disinhibition, euphoria, lack of criticism and insight, flight of ideas, and, in the acute state, great psychomotor restlessness. The symptoms of the frontoconvexity syndrome are a lack of drive, apathy, general decerebration, and torpidity. In both syndromes organic focal signs are found on neurological examination. A mixture of these two syndromes may occur. The diagnosis of a frontal lobe syndrome sometimes cannot be made and a prognosis is therefore not possible.

Sedatives, sometimes even soporifics, are necessary in the treatment of the frontobasal syndrome. In cases of frontoconvexity syndrome, the administration of psychostimulantia can be helpful.

Before an active rehabilitation can be achieved, it is necessary to have a psychiatric treatment of any Korsakoff symptoms, of a Klüver-Bucy syndrome, a delirium, or an exogenic reaction, especially an amential state with paranoid hallucinations.

Active Rehabilitation

Active rehabilitation is divided into the following phases^{7,10}:

- 1. The phase of first contact.
- 2. The activation phase.
- 3. The mobilization phase.
- 4. The stabilization phase.
- 5. The integration phase.
- 6. The resocialization phase.
- 7. The phase of aftertreatment.

All patients suffering from brain injury must have passed the most severe posttraumatic sequelae, especially the traumatic apallic syndrome, before active rehabilitation can be effective. During the first two phases, the patient remains in the intensive treatment station or an emergency ward. The transfer to a special rehabilitation center is necessary as soon as possible.

1. The First Contact

An attempt to make contact with the patient should be started as consciousness is beginning to clear. This is possible relatively early in cases with slight local cerebral symptoms but much later in patients with loss of higher brain functions and impaired consciousness (coma vigil). In the most severe posttraumatic sequelae, the traumatic apallic syndrome^{2,6,12,23,26} (catatonie traumatique,24 stupeur postcomateuse,4 coma traumatique prolongué, 3,16,22,29 coma grave prolongué,28 or whatever this chronic decerebration state is called) there is-besides the coma vigil and the lack of all higher brain functions-a modification of all primitive reflexes, including primitive motor patterns integrated in the brain stem, and a disturbance of the regulation of muscular tone (Fig. 31-4). Patients with apallic syn-



FIGURE 31-4. Traumatic apallic syndrome, full state 10 weeks after the brain injury. Coma vigil, flexed position of the limbs with contractures, Parkinson symptoms, marasmus, tonic neck reflexes.

dromes show a typical course of remission related to the reintegration of cerebral functions going through the phases of primitive psychomotor reactions, the grasping reflex, the Klüver-Bucy phase, the Korsakoff phase, and the phase of an organic psychosyndrome to a typical defect state, in some cases without remarkable residual symptoms.

Apallic patients in early remission may be trained to do more coordinated acts, such as bringing an object to the mouth, by integrating oral and grasping patterns. In this way, the patient learns how to handle a spoon and other implements. It is possible to train more complicated motor actions by patiently developing conditioned reflexes. The first direct contact with the patient is possible in the Klüver-Bucy phase. In this phase, the first vocal expressions in the form of primitive murmuring permits the beginning of speech therapy, and physiotherapeutic measures have to be intensified, starting with active movements.

2. The Activation Phase

During this phase, in which surgical care is becoming more and more a matter of convalescent treatment and intensive therapy has stabilized the somatic condition, the patient has to be increasingly activated. Physiotherapy plays a more active role. Current evaluation examinations, especially the neurological and electroencephalographic (EEG) controls, must be made. In less severe cases, the patient has to be gotten out of bed; in severe cases (apallic syndrome) the personal contact must be fostered. The remission has usually progressed to the Klüver-Bucy or the Korsakoff syndrome. At the end of this phase, the patient is transferred to the rehabilitation center if, from the surgical point of view, this is possible. Furthermore, nutrition demands must be met per os, and tracheostomies must be closed.

3. The Mobilization Phase

Based on the experience of the rehabilitation center of the University Clinic in

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Vienna, the rehabilitation unit should consist of 18 to 20 patients of both sexes. Patients live in a community department, complete with sleeping, living, working, and gymnastic rooms, like 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 two or three neuropsychiatrists, one or two psychologists, one orthopedist, a neurosurgeon, an ophthalmologist, and an otonasolaryngologist. The ward staff includes a logopedist, one or two physiotherapists, one or two social workers, one or two occupational therapists, a professional adviser, and a provisioner.

The rehabilitation station should have all modern physical therapies, modern drugs, and special facilities for common and special logopedia to train the higher brain functions.

The patients are divided into two groups: the mobilization group and the special therapeutic group in which intensive attention is given to the treatment of impaired functions (*Leistungsgruppe*). After transfer every new patient, irrespective of the severity of the posttraumatic sequelae, enters the mobilization group, which consists of four to six patients and is separated from the second group but is in close contact with the staff station.

New patients are evaluated for brain damage by clinical examination and other diagnostic procedures, such as electroencephalography (EEG), pneumoencephalography, laboratory examinations (blood count, cerebrospinal fluid, diencephalic test), electromyography (EMG), x-ray of the skull, and electrical examination. Ophthalmological, otonasolaryngological, and medical, and, if appropriate, gynecological examinations are made. Finally, a battery of psychological tests are carried out to obtain a "performance profile" (Fig. 31-5). This profile in our center is based on a test devised by Quatember et al.21 to demonstrate various abilities. In this way general knowledge, comprehension, and memory, as well as arithmetic ability, visual concentration, combination ability, and expressive and perceptive speech, are examined.

Based on the results of all the examina-



FIGURE 31-5. Performance profile. Contusio cerebri, lesion of left parietal region, with right hemipareses, amnestic aphasia, and feeble mentation.

The Late Effects of Head Injury

tions, an individual rehabilitation program is drawn up for every patient at a conference of the whole staff. The program considers the individual's social and professional status.

After this examination period, the mobilization of the brain-injured patient begins. Depending upon the organization of the rehabilitation station, the patient is kept more or less in continuous contact with other patients to encourage interpersonal relationships.

4. The Stabilization Phase

As soon as the somatic condition permits, the patient is placed in the special therapeutic group. These people 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. There is a fixed daily program for the special therapeutic group, with assigned time for common training, working, individual training, shopping, and visiting.

Based on the clinical picture and professional interests, subgroups are formed. Patients of the various subgroups have varying degrees of cerebral damage and are in different phases of rehabilitation. Because of these differences, there is an "ordering of achievement," which activates compensation tendencies and motivation, causing patients to help each other. If one patient is unable to walk, he will be assisted by a motor-semirehabilitated person who perhaps has an aphasia. So a real "therapeutic community" is established, and at the same time the number of paramedical persons is increased. Productivity is stimulated by group dynamics as each patient wants to do better than the others. 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 production, there is a "collective compulsion" to produce. A dynamic tension exists between doctors and nurses, especially the

chief nurse. In the center are the patients, as individuals as well as a group. Every week the status and progress of each patient is evaluated in regular staff sessions. Regular checks, such as EEG's, laboratory tests, psychological tests (the performance profile), and if necessary EMG's, electrical examinations, orthopedic examinations, et cetera, are made.

The aim of the stabilization phase is to train, stabilize, and augment the undamaged brain functions.

5. The Integration Phase

While the previous phase systematically trained the remaining functions, the aim of the integration phase is to repair the partly disturbed or damaged functions and to build up compensative mechanisms. The main principle of rehabilitation is to train and augment remaining functions rather than to exercise destroyed faculties. The performance profile indicates the necessary direction of the training (Fig. 31-5), which is determined for the individual by the weekly team sessions. Compensative functions are evaluated and systematically trained if improvement of primary functions is not noted for a long time. If surgical procedures are necessary to eliminate or improve orthopedic problems (periarticular ossifications, shortened tendons, et cetera), they should be done before active contact with the professional problems arises.

Another important aspect of this phase is to include the relatives of patients in the rehabilitation program. This can be done by bifocal group therapy, which Gastager⁵ has found effective with schizophrenic patients. The relatives must be informed of the intensity of the brain injury and the expected sequelae. They should be taught to recognize changes in the patient's personality as well as epileptic seizures. At the end of this phase the first visits home may be made if the patient's physical condition allows.

Permanent contact with relatives permits an indirect influence on the patient and pro-

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vides continuing information on the patient's progress. By enlarging the rehabilitation program, one or more patients may be added to the subgroup for music or drama therapy. Sometimes the first neurotic reactions appear in this phase. If this happens, therapeutic methods are introduced.

6. The Resocialization Phase

While the patient is still in the special therapeutic group on an individual program, contact with his work should be made. The social worker should discuss questions relating to the patient's former occupation and evaluate his chances of returning to his previous position, of changing to another job, or of accepting invalidism. This is the time for regaining contact with friends and colleagues.

7. The Posttreatment Phase

The patient may be discharged from the rehabilitation center when the clinical symptoms of brain injury have disappeared or have become stabilized. The juvenile brain has an enormous capacity to compensate. In our experience, these compensatory abilities are greatly decreased in persons past 40. Rehabilitation depends upon the ability of the human brain to compensate for functions of damaged regions. But even in a juvenile brain there is no possibility of full



FIGURE 31-6. Course of traumatic apallic syndrome with successful rehabilitation. a—Full state. b—Beginning remission. c—Klüver-Bucy phase. d—After rehabilitation.

restitution if the local or diffuse brain damage is beyond a certain degree of severity. Almost any stabilized defect tends to improve spontaneously, principally as the result of an adaptation to the environment.

The appropriate time for discharge must be determined by consideration of the stabilization of the neurological and psychiatric states, the healing of somatic injuries (e.g. bone fractures), the progressive diminution of employability with increasing invalidism, and the degree of vocational and social rehabilitation achieved. Personal factors such as quiet family life are of great importance.

Before discharge the nearest relative must be informed of the patient's outlook by the doctors and the social worker. Holidays with near relatives are desirable in our experiences, especially if the brain damage is not too severe. Follow-up visits should be made, first once a week, later at longer intervals. At these times, a discussion of personal problems of the patient, sometimes with a psychotherapeutic import, neurological examinations, EEG's, psychological tests, and other appropriate diagnostic examinations should be made.

Problems in the family or at work should be investigated by the social worker. Great care has to be taken that the patient is not overstrained. Contact with most of the patients extends over years. Later contact is on a voluntary basis, as problems turn up.

Patients with severe damage are often best handled as outpatients for some time. They participate in the daily program of the therapeutic group but leave the rehabilitation center in the afternoon. Family problems may be handled in night clinics, in which case the patient spends the night and his spare time at the clinic.

RESULTS OF THE REHABILITATION CENTER OF THE NEUROLOGICAL CLINIC, VIENNA

As our experiences have shown, a surprisingly favorable rehabilitation may result, even with patients who have severe brain damage. It is necessary that each patient be cared for by a well-organized rehabilitation team with all neurological and psychiatric facilities.

Even patients with an apallic syndrome can achieve a favorable result (Table 31– 1). In the training for regaining or compensating the disturbed brain functions, one demands as much as possible of the patient without overtaxing his ability. If too much is asked, he will be frustrated; if too little, he will not overcome his weakness and will tend to regress. If psychic reactions occur, it is necessary to invoke psychotherapeutic measures; these are possible only in cases without severe brain damage and in cases in a remission state. However, our experiences show rehabilitation may be achieved in any case (Fig. 31–6).

	TABLE	31-1		
RESULTS OF	TREATMI	ENT AT	THE	REHA-
BILITATION	CENTER	FOR !	ГНЕ	BRAIN-
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Results	Moder- ately Severe Injury	Se- vere In- jury	Trau- matic A pallic Syn- drome	Total
No change in				
profession	35	21	6	62
Change of				- 19 - C
working place	3	6	3	12
Change in				
profession	2	12	5	19
Unemployed	3	1		4
Limited pension	2	$\hat{7}$	3	12
Permanent	(T)	S\$7.5	~	
pension		8	2	10
Reconvalescents	6	9	$\overline{2}$	17
Incompleted	0. 2 0		3754	
treatment	7	8	4	19
Children	Ì	5	4	10
Died	ĩ	ĭ	3	5
Total	60	78	32	170*

* Includes 158 male and 12 female patients.

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SUMMARY

Brain injuries are classified as commotio and contusio cerebri (cerebral commotio and contusion). However, for clinical purposes the symptomatology of brain stem lesions is designated as acute traumatic midbrain and bulbar syndrome. Cerebral commotio needs aftertreatment but no rehabilitation. The rehabilitation of severe brain injuries must be started shortly after the accident. The use of posture reflexes according to the method of Bobath¹ allows muscular exercises in the decerebrate state.

The organization of a rehabilitation

center requires a grouping of patients with specific programs. In the special therapeutic group, ordering of achievement and group approbation are of special importance. Each patient requires an individual program within the daily schedule of the group. Rehabilitation aims to improve the disturbed brain functions or to compensate for them. It begins with special training of the remaining cerebral functions.

The therapeutical community is of central importance in the rehabilitation system of brain-injured.

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