

The Assessment of Disability Caused by Severe Head Injury

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Patients with severe head injury have been admitted to JSMRU RAF Chessington for the last twenty years. These cases were studied by NR Lewis (1966, *Proceedings* 59, 623) who showed that many of those who had suffered severe head injury became fit enough to return to duty, and over the next few years P N Knight confirmed the observations (personal communication). The tragedy of the conflict in Northern Ireland has led to a further increase in the admission of patients with the effects of severe head injury. This problem has been compounded by the much greater survival rate after injury, due to the development of effective intensive care units. The emotional reaction to soldiers wounded in Ireland is inclined to distort priorities, so it should be emphasized that most admissions are of patients injured in road traffic accidents, or by cerebral catastrophes due to natural causes. We are now admitting such patients at the rate of between 1 and 2 each week, more than six times the rate three years ago, and we expect to admit 50–60 patients this year.

In severe head injury, the diffuse nature of the damage makes anatomical diagnosis less reliable than in more conventional neurology. It was decided to determine in what way our treatment was of value to these patients, but as soon as a study of the case notes of past patients commenced it emerged that there was no consistent pattern of recording history, examination and investigations so that the effects of treatment were blurred. It was decided to examine a complete batch of patients passing through Chessington, so from 1 January 1973 all severe head injury patients have been assessed and recorded in a standard fashion. It was also decided that each discipline should make its own contribution, and the departmental assessments have been devised by the therapists. At the end of 1973 it is hoped to integrate and evaluate these assessments and produce a profile that will be acceptable as a standard for future work at Chessington, and that ultimately it will be possible to remove much that is redundant in the present system, which we recognize to be unrealistic for clinical use.

Each patient admitted to the trial is initially examined by a doctor who verifies the source of information and in addition to clinical examination finds out if litigation is pending. This is followed by neurological and medical examinations. In the succeeding week the patient passes through each department in turn.

The speech therapists' assessment is directed towards finding minimal lesions in apparently normal patients and establishing communication with those severely handicapped in speech and language. Where difficulties are minimal and do not warrant treatment, it is still necessary to help the patients to be aware of and to understand their problems, and to adjust to them. It is also necessary to help those with whom the patient comes into contact to understand his difficulties. A screening test for minimal cortical loss was devised to pick up such problems. The assessment covers the following points:

(1) *Memory*: Including duration of post-traumatic and retrograde amnesia and evidence of deficiency in the ability to learn new tasks. Where the difficulty is severe enough to affect the patient's daily living, methods can be used for retraining which go beyond the simple repetition of tasks and which aim at developing memory function to help the patient to find his way around and to cope with a daily routine independently.

(2) *Perception*: Auditory perception: Before judgement can be made about a patient's ability to comprehend speech, it must be established that hearing and perception are intact. It may be necessary to train auditory perception for sounds alone, before any more complex work on comprehension can be attempted. Visual perception: Many patients have difficulty reading because of perceptual rather than dysphasic difficulties. It is important to make this distinction so that one can minimize the effects of visual disturbances when presenting written material.

(3) *Comprehension*: Items are included to assess the patient's ability to take in, interpret and use fairly complex pieces of information.

(4) *Reading*: The ability not only to read aloud, but to understand the content of what has been read is tested. Allowance is made for the patient's educational attainment and interest in reading.

(5) *Expression*: Evidence is sought for: Minimal word finding difficulties: Whereas this can often be merely a small though irritating problem, it assumes a greater significance in patients whose jobs are more verbally orientated. Perseveration of thought processes: The constant repetition of ideas can block the ability to communicate effectively. Disordered thought processes: As this is a more central difficulty there may be some associated receptive loss. Minimal syntactical

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errors. Dysarthria: A mechanical difficulty in speech, where thought processes are not disordered, may cause grave concern to the patient. It may be difficult to understand him because of slurring, tremor, festination, lack of volume control or breathlessness.

(6) *Writing*: The aim is to assess not only the mechanical aspect of writing but also the content and structure of what is written. The patient's previous ability is taken into consideration, and only those errors which could be due to minimal cortical dysfunction are considered as significant.

(7) *Subjective evaluation of personality*: Existence is noted of egocentricity, euphoria, lack of concentration, rigidity of thought processes, meaningless repetitive chatter and lack of insight into problems. Often before direct treatment can be started, some of these problems need to be overcome because they frequently affect his attitude to progress and treatment.

If, from the screening test, it is felt that a patient needs further investigation or has difficulties which are too severe to cope with this test, one or more of the following tests is used:

(1) Minnesota test for differential diagnosis of dysphasia. This is a standardized test used by many speech therapists to assess 4 aspects of communication, i.e. comprehension, expression, reading and writing.

(2) Milan token test for receptive dysphasia.

(3) Butfield's assessment for dysarthria.

(4) Wepman's test for auditory discrimination.

(5) Benton visual retention test.

(6) Peabody picture vocabulary test.

A report is then written and treatment planned. A tape-recording is kept of patients who need treatment and this is used for assessment purposes and as a record of treatment.

Education

The patient will then be referred to the Education Department. Here the patient's present performance is correlated with that shown when he was given recruit selection tests. The latter tests are not repeated but the deficit can be gauged by comparing others that have been shown to correlate well. As each of the three Services uses different tests, and because the sub-tests do not make allowance for the expected increase in verbal intelligence and slight decrease in non-verbal capacity with age, well tried and commercially available tests are used for the Chessington assessments. These are: Raven's progressive matrices; The Mill Hill vocabulary scales; Vernon's graded mathematics/arithmetic test.

The Education Officer has established an excellent liaison with the numerous Records Offices holding the relevant service documents and

is normally able to obtain an individual's recruit selection grades within minutes. A joint Service project was carried out in 1968 whereby each of the three Services tested a large intake sample on all tests used collectively, so equivalent scores and quotient equivalents can be computed which have a joint Service validity. Also, since for general analysis at Chessington all head injury assessments are on a 5 point scale, this degree of accuracy is easily within the scope of the proven correlations between the commercial tests and the Service tests under the main headings referred to.

Physiotherapy

The patient is assessed for locomotor ability, joint position sense, spasticity, superficial and deep sensation over the whole body and localization in the hand.

Locomotor assessment: Twenty-five progressions of movement are used, and these are based on a developmental sequence, as follows. The patient scores one point for each movement that he is able to perform unassisted:

Rolling and Standing

Supine to prone over right side	High kneeling
Supine to prone over left side	Gets to high kneeling
Prone to supine over right side	Crawling
Prone to supine over left side	Half stand, kneeling on right leg
Prone lying with elbow support	Half stand, kneeling on left leg
Bridging	Gets into half stand, kneeling on right
Sits in long sitting	Gets into half stand, kneeling on left
Gets to long sitting	Standing
Side sits right	Gets to standing
Side sits left	Stands on right leg
Gets to side sitting on right side	Stands on left leg
Gets to side sitting on left side	
Prone kneeling	
Gets to prone kneeling	

Assessment of spasticity: Here an attempt is made to determine the extent to which spasticity interferes with normal movement. It has been found that the alteration of the attitude of the head or body can influence the tone in the limb muscles and so each limb is tested in turn in the following sequence:

Lying	Standing
Lying head to right	Standing head to right
Lying head to left	Standing head to left
Sitting	

Results are graded as follows: 0, no voluntary movement, i.e. reflex activity only; 1, movement in one total pattern only, i.e. total flexion or extension; 2, as in 1, but with movement both in flexion and extension and with some control of proximal joint; 3, as in 2, but with independent movement possible in distal joints; 4, good independent movement of distal joints, with evidence of mass action on reinforcement; 5, normal.

Joint position sense: Each joint is tested throughout its full range, and graded accordingly: 0,

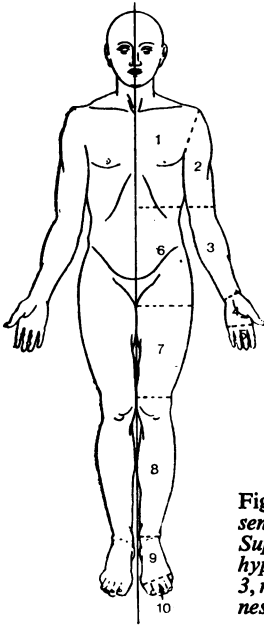


Fig 1 Superficial and deep sensation. Scale of grading: Superficial: 0, anaesthetic; 1, hypoaesthetic; 2, hyperaesthetic; 3, normal. Deep: 0, no awareness; 1, partial; 2, full

unaware of movement; 1, aware at extremes only; 2, aware of gross movement ($>60^\circ$); 3, aware of coarse movement ($>30^\circ$); 4, aware of fine movements; 5, normal.

Superficial and deep sensation: Each side of the body is divided into 10 areas (see Fig 1), and is tested by working from the proximal to the distal end. Superficial sensation is tested using light touch (cotton wool) and deep sensation by firm pressure from a blunt object such as the cap of a pen. These very simple tests were chosen to allow assessment of patients with severe word finding difficulty or other problems of communication.

Localization: This is tested in the palm, finger, and thumb of each hand and is done using light touch and is scored as follows: 0, unaware; 1, aware but out of area; 2, aware and in area; 3, aware to within 1 square inch (6.5 cm^2); 4, aware to within $\frac{1}{4}$ square inch (0.4 cm^2); 5, normal.

Assessments are made in the Occupational Therapy Department which try to relate the more academic and physical aspects to functional ability. These are designed at three levels, ranging from the basic ability to recognize simple objects through to a complex technical assessment in workshops. Additionally, a written report is obtained from the Wards which details the success of the patient's attempts to dress and feed himself, with comments on the patient's social behaviour, and any degree of incontinence. Finally, the patient is asked to try a small circuit in the gymnasium and the result is recorded on closed circuit television. Perimetry and audiometry will be added to the range of investigations in 1974.

These reports usually take one week to complete, when they are collated and reviewed. At the end of three months the departmental reports are repeated, and at each subsequent three month period and at discharge. It is the intention to document the recovery patterns of the patients in this way, and at the same time to develop a more refined series of tests for 1974. Methods that will allow rapid retrieval of all the information are also being developed and, when completed, it is felt that they too will have important clinical implications.

Acknowledgment: We wish to acknowledge our use of the experience from other units working on the assessment of head injuries whose methods we have developed or adapted, in particular the assessment of spasticity in use at the Robert Jones and Agnes Hunt Hospital, Oswestry.

The Management of Injuries to the Brachial Plexus

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One of the most devastating injuries that a young man can sustain is an injury to the brachial plexus affecting the dominant arm. During the past sixteen years 164 cases of brachial plexus palsy have been treated at the two rehabilitation units; Joint Services Medical Rehabilitation Unit, RAF Chessington and RAF Medical Rehabilitation Unit, Headley Court. This paper reports on 103 of these cases followed up to their final state and Table 1 shows the causes of injury.

It is well recognized that the prognosis depends on whether the lesion is preganglionic or post-ganglionic. Direct violence injuries such as gunshot wounds and blows on the neck are more likely to cause lesions distal to the posterior root ganglia while tractions lesions are likely to cause avulsion of the roots from the cord. If the lesion is proximal to the ganglion, the roots will have been torn from the cord and the prognosis is hopeless for nerve regeneration. If the lesion is

Table 1

Causes of brachial plexus palsies in 103 patients

Causes	No. of cases	Causes	No. of cases
Motor cycle accident	52	Carrying packs	5
Road traffic accident (car, lorry, jeep)	28	Parachuting	3
Gunshot wounds	7	Rugby football	1
Direct blow	6	Ejector seat injury	1