Needs and Opportunities in Rehabilitation

Rehabilitation after head injury—1: Cognitive problems

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In the course of my travels I saw two young people at two stages of their lengthy rehabilitation after severe head injury in road accidents. At a regional neurological unit a boy of 18 was taking his first steps nine months after his injury; I met him nine months later at a day rehabilitation centre, walking well and talking much more easily. The girl, also about 18, I first saw 11 months after her accident, barely conscious, in the rehabilitation department of a large residential home. Two years later she was still there, and I watched her in the physiotherapy room practising single steps and single sounds with great concentration; she was said to have guts and her family hoped to have her home one day. But intensive, specialist rehabilitation is available to few, and at some centres that do provide it courses may be too short.¹

The problem is sizable. Head injuries treated in hospital number 250 a year per 100 000 population, with a prevalence of 150 survivors with major disability per 100 000.² According to another estimate, each year 210 people are left "totally" disabled and a further 1500 "severely" disabled³; while it was estimated in 1967 that some 1000 people a year were left as "lamebrains" with permanent psychological impairment.⁴ Less than a fifth of survivors of severe head injury would be classified as severely disabled, mentally or physically, six months later.⁵ But they are mainly young, with years of disability ahead of them. Some survivors moreover pose enormous problems of long term care (2 February, p 369); I saw one man unnecessarily in a teaching hospital seven years after his accident, because his wife would not have him and nowhere else would either.

Nature of the problems

While both stroke and gunshot and other such wounds produce confined even if large lesions, closed head injury creates more widespread damage. Anoxia, poisoning, and encephalitis may have similar effects and victims of these disasters have the same needs as the head injured. Not only are groups of cells destroyed but neuronal connections are disrupted and thus integration of different brain processes is impaired.⁶ Hence the effects are complex and subtle, and mental changes dominate over physical.⁵ Cognitive and emotional handicaps are the chief cause of long term disability. Personality change has been found in two thirds of cases⁵—"He's not the man I married" is, sadly, an often quoted comment.

As with stroke (see 2 March, p 699) most natural recovery is concentrated in the first six months.⁵ But many neurologists and others, it has been said to me, make pessimistic predictions and write people off much too soon after the injury. Sometimes they quote the finding that most patients do not move any higher up the Glasgow Outcome Scale between six and 12 months.⁵ Ten per cent, however,

do move to a higher category; for the rest, substantial improvement well after this may leave people within the same broad category, in this system designed for large scale studies, and yet greatly improve their quality of life. The director of one unit expressed the view that no one can know what is possible after a severe head injury unless efforts have been made for a long time, quoting the case of a young man pronounced unhelpable by a leading neurologist, who after three months there was travelling home by bus. The prolonged and worthwhile improvements that occur with encouragement and training may represent aspects of "recovery" or new ways of doing things; Newcombe concludes that "the notion that all improvement takes place within two years will have to be revised for some functions and for some individuals."⁷ At the Kemsley Unit of St Andrew's Hospital, Northampton, patients having prolonged behaviour modification plus other therapy that started 10 months to over 10 years after injury showed general improvement.⁸ I heard of one very severely injured man who with continued interventions and encouragement was still improving well over 10 years after injury; meanwhile he had got married and set up house.

The mechanisms underlying recovery are immensely complex, even if the more speculative ones are discounted, and are inadequately understood.^{6 9-11} If there is some degree of plasticity, for example, in the organisation of the brain remedial therapy might be able to do more than speed up natural recovery: using new strategies for damaged functions such as language and memory might encourage changes in the functioning of the brain. The subject is controversial, but some therapy is based on such considerations. Remedial training is assumed to be most effective if it builds on natural recovery, so should gain by understanding of the processes concerned.⁹

Physical improvement, especially walking, and independence are of enormous importance for morale and mood. Improved therapy, says Newcombe, calls for a rapprochement of cognitive and neurophysiological studies of motor control.¹² But physiotherapy and occupational therapy methods are in general well established and successful, so I have chosen in this article to concentrate on a few of the growing points of cognitive training. The next article will include a look at behaviour and emotional problems and long term needs.

Cognitive problems

The faces of head injured people whose intelligence appears to have fled strike the visitor to a neurological unit. Even the less severe cognitive defects are among the most devastating (and frequent) results of serious head injury. Memory and learning are most vulnerable, and may be impaired after a post-traumatic amnesia of only a few days; deficits of attention are common, and partly explain these problems, and there is also a general slowing down, linked to reduced speed of information processing, and sometimes a drop in IQ on some or all subscales.^{6 11 12} Language, memory, visual and spatial perception, and attention and search all need to be assessed.¹²

All the remedial therapies may help such deficits, perhaps after assessment and advice from a psychologist; only the more intractable ones call for specific cognitive training if available. More generally, stimulation and education may be as great a need as in child development.

Miller concludes that there is not much firm evidence that current psychological forms of remedial therapy have great value; studies may not have been adequate, or possibly the benefits of present methods are rarely very great.⁹ But he expects advances to come, and points to the value of single case studies to assess methods that are tried. (See also Newcombe on single case studies.¹²) Particular problems are whether the specific improvements made in remedial training will generalise to other contexts and whether they will last, and become integrated into real skills in the real world.¹³ With general rehabilitation real life tasks are indeed the focus, but specific cognitive retraining is often based on "laboratory" or classroom tasks. Relatives have a valuable part to play here as in other forms of rehabilitation in helping the transfer of training to the home setting.

An educational therapist is sometimes used for concentrated individual and group work,¹⁴ using modern aids. Games for non-verbal stimulation can be important. The spread of the micro-computer is perhaps the best recent development—for identifying and assessing deficits and progress and providing remedial exercises,¹⁵ including memory, concentration, and reasoning tasks and reality orientation¹¹ questions. Ordinary computer games may be useful and entertaining, but more specific remedial programs are needed and a few do exist (19 January, p 221); there are benefits in programming remedial tasks in the form of computer games (p 146⁹). The work being done at the Aids for Communication in Education (ACE) Centre of the Ormerod School in Oxford has potential relevance for brain injured people.¹²

MEMORY

Memory defects from whatever cause are difficult to treat. Memory has different components (notably verbal and visual) and comprises different processes, and the choice of training strategy is dictated by the nature of the loss. But as memory depends on the ability to assimilate and process information, which is so often impaired in some way by head injury, retraining of memory may be a chimera; the task is to find ways round the defect.

The various approaches are described in Wilson and Moffat.¹⁵ Some people appear to be helped by, for instance, mnemonics or, if they have intact visual memory, imagery methods. Memory games and exercises have the value of giving sufferers the sense of support and encouragement. Since a questionnaire survey in 1981 of the attention given to memory problems¹⁶ (rated on the whole as only marginally effective) memory training has spread considerably. Though successes are reported,¹⁵ psychological methods tend to have disappointing results: progress may not be generalised, and, though testing may show improvement, coping with the actual problems of life often does not improve.⁹ ¹⁵ Practical assessment and management methods for everyday problems have been described.¹⁵ ¹⁷ Some people compensate successfully for severe memory defects with the help of notebooks, alarms, and other aids and cues such as signs and notices around the place.⁷ ¹⁵ A young man I met, with unrealistic hopes of a diploma in horticulture, was being taught to use a notebook to remind him, for example, of what he was supposed to be doing in his gardening. The problem often is to remember to use the notebook.

One substantial study with promising results, both on testing and in real life, was carried out in Wisconsin.¹⁸ Psychological methods were learnt, with copious use of diary and notebook, in an intensive memory training that emphasised transforming information into the patient's own words, concepts, and images. A British rehabilitation centre used this system with four patients. The strategies taught during 12 sessions were reinforced by other staff throughout the day, and when assessed all four knew them well. But they forget to use them. (Sufferers need to *remember* that they have a problem.¹⁸) The results thus were not thought to justify the staff time needed, and the authors thought that microcomputer training, perhaps

Teachers in rehabilitation

A young man who had a gunshot wound in the left temporal area and was totally unable to read three years later was then given remedial teaching without success.²⁵ He refused to accept that he would never read. Five years after the injury he had three months of teaching, using a phonetic method, from a remedial teacher at an adult training centre, with advice from the psychologist of a rehabilitation centre. He reached a reading age of 9 years, and has continued to work at his reading on his own. Another approach to long term remedial teaching, after formal rehabilitation has stopped, is the recently opened acquired aphasia unit attached to the English and adult studies department of Evesham College of Further Education. This is using volunteers as teachers, mainly for reading, under the guidance of the department. A teacher is right from the start a member of the head injury rehabilitation team at the University Hospital and Cedars Rehabilitation Centre, Nottingham; even in the acute ward she begins to form a relationship with the patient. Mrs Cynthia Stevens recently held a study day in Nottingham for educationists on head injury rehabilitation and plans to arrange others.

concentrating on the deficits in attention, would be more practicable and more suited to the early stages when strategies may be too complex (I Fussey and A D Tyerman, unpublished paper).

ATTENTION

Attention comprises several elements—notably speed of information processing, selectivity, and alertness and concentration on a task. The first and last are often disrupted by head injury. Not only do memory processing and learning depend on components of attention but previously automatic activities such as walking may need conscious attention after brain damage. Attention training¹⁵ is provided at, for example, the head injury unit of the Joint Services Medical Rehabilitation Centre and the Kemsley Unit.⁷ ¹⁵ Two possibilities are paced serial addition (auditory, on tape) and microcomputer picture matching, the latter permitting reinforcement every half minute with a pleasant or unpleasant sound (or more tangible reward). Computer training programs have been developed by Wood.¹⁵ Purely behavioural methods using reinforcement have also been found useful.¹⁵

At the Kemsley Unit rewarding attention and so increasing the attention span has been found to improve cooperation in the various remedial therapy sessions; and rewarding attention to a micro-computer task may lead to increased attention in other contexts, though this has not so far led to cognitive improvement (R Wood, personal communication). Attention training may increase a person's monitoring of his own behaviour and the capacity to put together the different elements needed for improving a given function: for instance, a girl in the unit was helped to attend to all the components of her speech problem, including breathing and grimaces. Work in this area is, however, at an early stage and more reports are needed. The use of vestibular stimulation to increase arousal has been reported from the Kemsley Unit,²⁰ but no other reports on this approach appear to have been published.

COMMUNICATION

I touched on some of the issues and uncertainties of communication and speech therapy in the context of stroke (9 March, p 768). Miller gives a critical review of the subject⁹ (see also refs 11, 12, and

21). Some rehabilitation centres are able to give much more intensive language therapy than is normally possible and are convinced that this makes a big difference; more trials are needed, however, with careful design. If there is some intact language as distinct from speech ability, people with head injury are more likely than those with stroke to profit from an alternative system of communication, including a communication aid or even a simple artificial (symbolic) "language" (reviewed by Rowley²¹). Even so, they are often resistant to such substitutes and the aim, it is suggested, should more often be to use them as supplements to speech and not replacements (p 721). Code and Müller urge that patients should not stop communication therapy, even though improvement may have ceased, while they have psychosocial problems, especially in the family, due to aphasia.²¹

The DHSS has several centres for communication aids. There are useful sections in publications by Jay,^{22 23} and pamphlets from the

A young man at Rivermead Medical Rehabilitation Centre, Oxford, who had been shot by an airgun pellet two years before, doing the Wisconsin card sorting test to show whether frontal lobe damage is present. On the wall is an algorithm for deciding on a treatment strategy for memory impairment (p 100¹³).

College of Speech Therapists and Action for Dysphasic Adults (addresses in last article, p 768).

Some of the references for this and other subjects in my articles on stroke (2 and 9 March, pp 699 and 768) are relevant to head injury.

THE FUTURE OF COGNITIVE REHABILITATION

Ben-Yishay and Miller describe the elements of their cognitive remediation programme in New York and Israel.¹¹ They are set in a daily programme that also includes personal counselling, small group training in interpersonal skills, and community type activities. This lasts about a year. The patients have been unresponsive to previous efforts at rehabilitation. Follow up of over 60 people treated since 1975 is said to indicate compellingly the success of the programme, but data on outcome have not been published; enabling patients to work to their full potential, rather than cognitive changes as such, is thought to be the crucial point. In the United States cognitive rehabilitation is growing "in geometric proportions," but there have been few well controlled studies and standards for cognitive rehabilitation programmes (now in a final draft) have been drawn up to introduce scientific rigour and credibility (Professor J A Mikula, Lake Erie Institute of Rehabilitation, chairman of the Task Force on Head Injury of the American Congress of Rehabilitation Medicine—personal communication). A British psychologist expressed the view that despite our different circumstances such standards would be relevant in Britain. Subjects covered include staff training, assessment of patients, goals and treatment plans, and evaluation of programmes. (Standards for early and late rehabilitation programmes are also in preparation.)

What then of the future for cognitive rehabilitation? Firstly, even the more cautious believe that it is in general worth pressing on with these approaches, with plenty of rigorous evaluation. Secondly, there are not enough clinical psychologists to give training to the many head injured people who need some help and the relatively few who need intensive help. But much of the actual training can be given by other staff, notably occupational and speech therapists; this happens even where a full time psychologist is available. Thus the need is for psychologists to work out in detail the approaches and techniques to be used for each person and study the response, with changes of strategy as needed.¹³ But in Britain as a whole there are too few psychologists to do even this for everyone who needs it.

Finally, training needs to be very precise, based both on theory⁷ and on empirical trials. Remedial methods should be grounded both in educational psychology and in the specific needs of brain damaged people, and then specifically tailored for each individual. A controlled study of head injured people showed them capable of appreciable and prolonged learning, with transfer of training, in a psychomotor skill.²⁴ The successful approaches to training mentally subnormal people, it was concluded, should provide a starting point for developing strategies—for example, breaking a task down into separate steps—provided that these could be remembered in the long term. A highly structured approach to remedial training is accepted,¹⁴ with computers as important tools in many cases,¹⁵ though much more programming of remedial teaching material is needed. But detailed educational strategies are in their infancy.^{13 24} An educational therapist emphasised the importance of the educational as distinct from medical approach, with patients responsible for their learning rather than passive recipients of treatment.

No less necessary is the acceptance that many head injured people can go on learning, however slowly. That they should have the chance to do so is not perhaps a completely utopian ideal. Exciting possibilities are suggested by the use of teachers both as members of the rehabilitation team and for longer term help to individuals (see box). This too is at an early stage but interest is growing. The needs are detailed guidance from psychologists and training workshops for interested teachers—based in the long run on a more specialised educational psychology of head injury.

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Lesson of the Week

Osteomalacia presenting as pathological fractures during pregnancy in Asian women of high socioeconomic class

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Osteomalacia is widely prevalent in the Asian immigrant population at clinical¹ and subclinical^{2,3} levels, especially in those who are vegetarians. Pregnancy is associated with increased demands for vitamin D and hence may be responsible for the induction of clinical osteomalacia⁴ among women who may otherwise have only biochemical, subclinical abnormalities. We describe two vegetarian Asian women who presented with pathological fractures during the third trimester of pregnancy, having been completely asymptomatic before pregnancy. So far as we know this is the first report showing the occurrence of such fractures in pregnant women who were asymptomatic before pregnancy.

Case 1

A vegetarian primigravid Asian chartered accountant aged 28 developed pain in her foot during the seventh month of pregnancy. The pain gradually increased and she was referred for an orthopaedic consultation. She had tenderness and swelling over the metatarsal bones and a radiograph confirmed fractures of the metatarsals. She also stated that she had aches and pains in her chest and pelvis and weakness, with difficulty in climbing stairs. She had proximal myopathy.

Plasma biochemical studies confirmed osteomalacia—calcium concentration 2.0 mmol/l (8.0 mg/100 ml); phosphate 0.7 mmol/l (2.1 mg/100 ml); alkaline phosphatase activity 222 IU/l (normal 30-120 IU/l); albumin concentration 38 g/l. 25 Hydroxyvitamin D was not detectable and serum parathyroid hormone concentration (N terminal assay) was 320 ng/l (upper

Osteomalacic fractures may occur in pregnancy in Asian women irrespective of socioeconomic state

limit of normal 120 ng/l). She was treated with calciferol, 600 000 IU by intramuscular injection, and with one tablet of calcium and vitamin D daily. Over the next four weeks the pain in her foot subsided, the aches and pains disappeared, and the proximal myopathy resolved. Plasma calcium and phosphate concentrations became normal. At term she delivered a normal baby who had no neonatal complications.

After delivery she stopped taking vitamin D tablets and did not attend for follow up. She breast fed her baby. Six months after delivery she presented with diffuse aches and pains and inability to carry her baby in her arms. She had diffuse bony tenderness and severe proximal myopathy. Plasma calcium and phosphate concentrations had fallen, while alkaline phosphatase activity had increased. She was treated with calciferol and calcium+vitamin D tablets. She again lost her symptoms within four weeks and continued to take vitamin D supplements thereafter.

Case 2

A 25 year old Asian vegetarian primigravid biochemist (the wife of a pharmacist) presented with severe pain in hips and feet of four days' duration during the seventh month of pregnancy. These pains had kept her in bed. She had had mild to moderate pain in her hips in the earlier part of her pregnancy. She had been taking calcium, iron, and folic acid supplements for the duration of pregnancy but had taken no vitamin D. There was noticeable limitation in movement of both hips, more prominent on the left.

Radiography of the hips showed Looser's zones in the femoral neck bilaterally with severe demineralisation; radiographs of feet showed fractures of metatarsals on both sides (figure). Plasma biochemical values were: calcium concentration 2.02 mmol/l (8.1 mg/100 ml), phosphate 0.7 mmol/l (2.2 mg/100 ml), alkaline phosphatase activity 178 IU/l, and albumin concentration 35 g/l. Serum iron concentration was 20 µmol/l (112 µg/100 ml) with a total iron binding capacity of 66 µmol/l (369 µg/100 ml). Serum 25 hydroxyvitamin D was not detectable. She was treated with 300 000 IU of calciferol by intramuscular injection and also given oral vitamin D supplements.

The pregnancy continued uneventfully and at 38 weeks she delivered spontaneously a normal baby.

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