

The Space Time Continuum of Neurorehabilitation

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BACK TO THE FUTURE ?

It is apposite as we approach the third millennium, and celebrate the beginning of a third century of medical care in the Royal Victoria Hospital, that we consider the place of the "third phase of medical care" both now and in the future. This was the term applied by Howard A. Rusk to rehabilitation in the period immediately following the Second World War¹. Rusk is regarded as the pioneer of medically led rehabilitation expounding the philosophy:

"medical care can not be considered complete until the patient with a residual physical disability has been trained to live and work with what he has left".

Although the terminology and emphasis has changed in the intervening years, this remains the central principle underpinning the practice of neurorehabilitation today. Neurorehabilitation is indeed the application of the principles and practice of rehabilitation to those persons disabled as a result of neurological illness or injury. It's practice is not new, although it has advanced.

In 1949 Dr. Rusk described a report of neurorehabilitation in treating 130 patients with chronic neurological disease all but two of whom were veterans of the First World War. Many of these had been bed-bound for ten years and after nine months of physical medicine rehabilitation all but ten had shown worthwhile permanent improvement². While the nature of their physical disability is not detailed, this unblinded and uncontrolled study does demonstrate that even at a late stage, that rehabilitation is effective. We are still having to prove the benefits of rehabilitation as we seek to achieve service development, despite such evidence being available.

SERVICE DEVELOPMENT

Following World War Two, two separate models of service delivery were developed. Rusk pioneered general rehabilitation facilities where people disabled due to various conditions were treated by a therapy

team under the direction of a specialist in Physical Medicine and Rehabilitation. Indeed in 1947, he was the Chief of Physical Medicine and Rehabilitation Service at Bellevue Hospital in New York, the first comprehensive total Medical Rehabilitation Program in America. This has formed the basis for similar units and programmes throughout USA, UK and Europe.

An alternative concept, which for at least one group of patients has been fully accepted, is the specialist unit dealing with all phases of care for persons with a specific cause for their disability. Sir Ludwig Guttmann³ pioneered the specialised Spinal Injuries Unit, incorporating acute medical and surgical care with specialised rehabilitation for a single condition. The success of this model is apparent, with centres such as Stoke Mandeville Hospital developing a world wide reputation and the concept gaining acceptance worldwide. The concept of pure specialist Spinal Injuries Units treating a single condition is under critical review and Spinal Injuries specialists perceive themselves as being under threat from Rehabilitation Medicine. Already in some centres, there is a shift towards integration of service under the heading of Neurorehabilitation Units. The integrated acute care and rehabilitation service has now gained acceptance in management of Stroke with the development of acute Stroke Units and Stroke Rehabilitation Units being shown to influence both mortality and morbidity^{4,5,6}.

BRAIN INJURY REHABILITATION

The development of specialised services for brain injured patients has, surprisingly given the size of the problem, lagged behind those services outlined above. Gradually, however, recognition of their problems, again following war - namely the Seven-Day War in Israel in 1975, and the use of appropriate therapeutic interventions for cognitive and behavioural dysfunction stimulated the development of brain injury rehabilitation⁷.

During the 1980s there was a very rapid expansion in specialised brain injury programmes in the United States and this has to a lesser degree been mirrored in

the United Kingdom. Supraregional highly specialised units such as the Kelmsley Unit at St. Andrew's Hospital in Northampton and The Royal Hospital for Neurodisability Putney have been to the fore in head injury management in Great Britain with many other facilities and services now being established throughout the country. Most of these are in the private sector with as yet no network of head injury units to match the network of spinal injuries units despite the much greater incidence of brain injury and the greater complexity of problems that it presents.

The lack of such a network, with an agreed approach to care by those involved, means that few areas of the country, if any, have an integrated programme of care for people with brain injury. Not only must such a programme of care deal with the acute and sub-acute periods, but a range of services within the community setting are required for long term problems, mainly of cognition and behaviour, but also physical disability.

MODELS OF SERVICE DELIVERY

Cope⁸ has defined the elements of comprehensive brain injury rehabilitation as:

1. Expert medical and nursing care in directing and providing the rehabilitation process
2. The prevention of secondary deterioration
3. Maximisation of natural recovery processes
4. Facilitation of incremental functional gain through specific (rehabilitation) intervention
5. Provision of an optimal environment for neurological recovery
6. Provision and teaching of compensatory techniques including cognitive strategies
7. Provision of appropriate equipment
8. Provision of adaptive environmental modifications

These various elements are required throughout the space time continuum of brain injury rehabilitation.

Burke⁹ has reviewed the range of models of brain injury rehabilitation including the comprehensive centre, cognitive rehabilitation; behaviour rehabilitation, slow-stream rehabilitation; coma arousal programme, acute, outpatient, transitional and vocational rehabilitation programmes. The evidence indicates that, apart from coma arousal the efficacy of which remains unproven, all these programmes have a

place in brain injury rehabilitation services.

It is axiomatic that understanding of the physical, cognitive and behavioural problems and the use of specific rehabilitation measures for them will be required in the temporally separate rehabilitation programmes to ensure their success. It appears self evident that the earlier rehabilitation is begun the more likely it is to be effective.

EARLY REHABILITATION

Delay into rehabilitation programmes has been shown to be associated with the development of avoidable complications, which by their presence further impede progress in rehabilitation¹⁰. Although this paper is almost thirty years old, the complications of "frozen shoulders", joint deformities, decubiti and indeed poor nutritional status remain an issue for patients who do not gain early access to an inpatient rehabilitation programme.

Cope and Hall¹¹ have demonstrated that delay of patients into a specialised rehabilitation programme leads to both an increase in the length of time within the programme and the patients total length of stay. Mackay et al¹² have studied the provision of rehabilitation therapies at an earlier stage again. They report that when therapy was begun for patients while they were still in coma there was a significant improvement on a range of outcome measures. The benefits of early rehabilitation for these patients are reduced length of stay and improved functional status at discharge. In the Cope and Hall study continuing benefits were noted in terms of level of disability and social functioning on long term follow-up. A further study¹³ suggests that there is a positive correlation between the length of stay, intensity of treatment and the outcome of a brain injury rehabilitation programme.

POST-ACUTE REHABILITATION

Post-acute rehabilitation may be provided on an outpatient or residential basis. In those patients receiving outpatient rehabilitation improvements in physical, functional and cognitive status have been reported and these have occurred independently of the time from injury to commencing outpatient treatment^{14,15}.

Similar benefits were reported by Johnston and Lewis¹⁶ in 82 patients entered into residential community re-entry programmes. Highly significant decreases in need for supervision and care with an improvement in independent living and productive

activities were noted. Improvements occurred independently of the time from injury demonstrating a benefit of the programme rather than spontaneous improvement. Similar benefits are reported by Cope et al¹⁷ in their analysis of comprehensive rehabilitation within a co-ordinated system of post acute programmes.

A small number of studies have reported some success in vocational rehabilitation programmes for brain injured patients. This remains one of the most difficult areas with a high post injury rate of unemployment.

The role of neurobehavioural rehabilitation was initially reported by Eames and Wood in 1985^{18,19}. Such as been its success that their methods are incorporated into many rehabilitation programmes today,

‘NO MAN IS AN ISLAND’

It must be remembered that none of the above interventions or programmes cures the patient and that long term problems will persist. No patient exists entirely in isolation and the occurrence of brain injury has effects on all family members. Some recent studies highlight this. Gervasio and Kreutzer²⁰ in a study of 116 family members of a sample of outpatients with brain injury report that they feel alienated, isolated, overwhelmed and mentally preoccupied, with spouses experiencing most distress. This is probably implicated in the 49% divorce/separation rate in a sample of 131 couples with one partner brain injured as reported by Wood and Yurdakul²¹. It is of note that there was an association between duration from injury and separation/divorce indicating the cumulative nature of stress on the uninjured partner.

BACK TO THE FUTURE !

When taken as a whole, these studies demonstrate the positive benefits of a specialised neurorehabilitation service for brain injured patients. Similarly, neurorehabilitation has proven benefits in patients suffering from stroke and spinal cord injury. Patients with a variety of other neurologically disabling conditions, both progressive and non-progressive, can benefit from neurorehabilitation. Its principles should, therefore, be incorporated into Paediatric, Adult and Geriatric medical practice with the development of specialist programmes crossing these age related boundaries.

I have deliberately avoided discussion on specific therapy and pharmacologic developments. These while, in themselves, of value contribute to the totality

of the rehabilitation process rather than transform it by their actions. When we look at the number of individual professions who may be part of the Rehabilitation Team we can see that the whole is indeed greater than the sum of its parts. (Table 1)

TABLE

Professions involved in Neurorehabilitation team

Doctors
 Physiotherapists
 Occupational Therapists
 Speech & Language Therapists
 Nurses
 Dieticians
 Psychologists
 Orthotists
 Rehabilitation Engineers
 Social Workers
 Recreational Therapists
 Chaplins
 Podiatrists

As the Royal Victoria Hospital enters it's third century it will be faced with more challenges. Advancing medical and surgical practice has improved the survival of patients following trauma and other conditions such as stroke. Unfortunately, the day when acute intervention will provide a cure for disabling conditions such as brain injury, spinal cord injury and stroke still seems some way off. The demands for rehabilitation will increase and planning for such a service should be central.

REFERENCES

1. Rusk H A. Advances in Rehabilitation. *Practitioner* 1959; **183**:505-512
2. Rusk H A. Rehabilitation. *J.A.M.A.*1949; **140**:286-292
3. Guttman L. Spinal Cord Injuries. Comprehensive Management and Research (Blackwell Scientific Publications, Oxford), pp 1-21:1973
4. Dennis M, Langhorne P. So Stroke Units save lives: Where do we go from here? *Br.Med J* 1994; **309**:1273-1277
5. Kalra L. The influence of Stroke Unit rehabilitation on functional recovery from stroke. *Stroke* 1994; **25**:1-821- 825

6. Stroke Unit Trialists' Collaboration. Collaborative systemic review of the randomised trials of organised inpatient (Stroke Unit) care after stroke. *Br.Med J* 1997; **314**:1151-59.
7. Boake C. A history of cognitive rehabilitation of head injured patients, 1915-1980. *J.Head Trauma Rehabil* 1989; **4**:1-8
8. Cope D N. The effectiveness of traumatic brain injury rehabilitation: A review. *Brain Inj* 1995; **9**:649-670
9. Burke D C. Models of brain injury rehabilitation. *Brain Inj* 1995; **9**:735-744
10. Rusk H A, Block J M, Lowman E W. Rehabilitation following traumatic brain damage. *Med Clin North Amer* 1969; **53**:677-684
11. Cope D N, Hall K. Head injury rehabilitation: Benefit of early intervention. *Arch Phys Med Rehab* 1982; **63**:433-437
12. Mackay L E, Bernstein B A, Chapman P E, Morgan A S, Milazzo L S. Early intervention in severe head injury: Long term benefits of a formalized program. *Arch Phys Med Rehab* 1991; **73**:635-641
13. Spivack G, Spettle C M, Ellis D W et al. Effects of intensity of treatment and lengths of stay on rehabilitation outcomes. *Brain Inj* 1992; **6**:419-434
14. Sscherzer B P. Rehabilitation following severe head trauma.. Results of a three-year program. *Arch Phys Med Rehab* 1986; **67**:366-374
15. Mills V M, Nesbeda T, Katz D I, et al. Outcomes for traumatically brain-injured patients following post-acute rehabilitation programmes. *Brain Inj* 1992; **6**:219-228
16. Johnston M V, Lewis F D. Outcomes of community re-entry programmes for brain injury survivors. *Brain Inj* 1991; **5**:141-154
17. Cope D N, Cole J R, Hall K M, Barkan H. Brain injury: Analysis of outcome in a post-acute rehabilitation system. *Brain Inj* 1991; **5**:111-126
18. Eames P, Wood R. Rehabilitation after severe brain injury: A special unit approach to behaviour disorder. *Int Rehab Med* 1985; **7**:130-133
19. Eames P, Wood R. Rehabilitation after severe brain injury: A follow up study of behaviour modification approach. *J Neurol Neurosurg Psychiatry* 1985; **48**:613-619
20. Gervasio A H, Kreutzer J S. Kinship and family members' psychological distress after traumatic brain injury: A large sample study. *J Head Trauma Rehabil* 1997; **12**:14.26
21. Wood R H, Yurdakul L K. Change in relationship status following traumatic brain injury. *Brain Inj* 1997; **11**:491-502