ABC of Spinal Cord Injury

DAVID GRUNDY
JOHN RUSSELL

LATER MANAGEMENT AND COMPLICATIONS—II

Psychological factors

Factors

- Acute stage —sensory deprivation, most noticeable in high lesions
  —swings in mood: fear, anger, depression, euphoria, frustration
- Later stages—long period of adjustment required (2-3 years
  —continuing support necessary

The initial psychological adjustment to a spinal cord injury has already been discussed, but long term support may also be required. The frustrations associated with the physical limitations of such a severe injury are compounded by the fact that most patients are young and before injury led active lives, often expressing themselves mainly through physical activities. The sudden inability to continue in this manner and the need to lead a more ordered life can mean a very difficult and prolonged period of adjustment. Failure to recognise that this process can continue for as long as two or three years may damage the process of rehabilitation and the patient's ultimate resettlement. The patient needs time to come to terms with his or her new status and to make decisions about the future without undue pressure. Continuing support will be needed after discharge from hospital, both from community services and from outpatient visits, and the problems and fears of the able bodied partner or close relatives must also be remembered.

The hand in tetraplegia

Aims

- To restore active elbow extension
- To provide a functional grip

Factors in selection for surgery

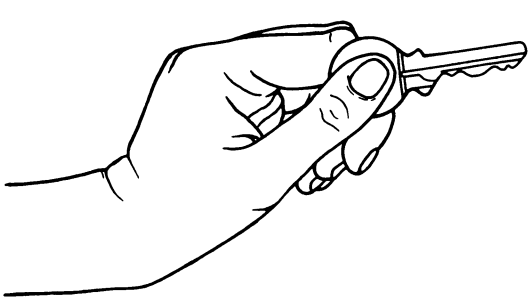
- Neurological level below C5
- No change in muscle power for at least 6 months
- Adequate sensation in hand
- No spasticity or contracture
- Well motivated patient

Most tetraplegics give priority to restoring function in their arms. In selected patients with injuries below the fifth cervical segment surgery may be helpful, the main aims being to restore active elbow extension and provide a functional hand grip. An important factor in selection is motivation, as treatment will be prolonged, requiring perseverance and cooperation from the patient. Surgery is particularly indicated in complete lesions, the muscle chart having shown no change for at least six months, and there being adequate sensation in the hand. There should be no spasticity in the limb, and any contracture must be previously corrected by physiotherapy or splintage.

Restoring elbow extension by transferring the posterior third of the deltoid muscle into the triceps tendon enables a patient to reach overhead and facilitates wheelchair transfers and lifting to relieve pressure. Good results from surgery have been achieved in 80% of patients.

To provide a functional hand grip active finger flexion must be restored. If wrist extension is normal the extensor carpi radialis longus can be transferred into the flexor digitorum profundus and independent thumb flexion made possible by transferring the brachioradialis into the flexor pollicis longus.

An alternative approach, probably the most generally useful, is that described by Moberg, in which a strong key pinch grip is provided by tenodesis of the flexor pollicis longus to the lower end of the radius with stabilisation of the interphalangeal joint of the thumb in a straight position. With the wrist extended the thumb will then oppose the radial side of the index finger. This procedure can also be combined with transfer of the extensor carpi radialis longus to the flexor digitorum profundus to restore active finger flexion. There is an almost 70% success rate after surgery to restore a functional hand grip provided the muscles used for transfer are normally innervated.

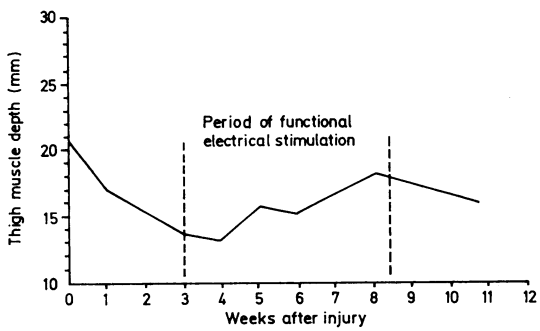


Key pinch grip, achieved by using the Moberg technique.

Functional electrical stimulation

Aims

- Leg —to augment, or dispense with, conventional calipers
  —to restore walking in patients who otherwise would not be able to walk using conventional calipers
- Arm—to re-establish hand grip



Variation in thigh muscle depth, shown by ultrasound. Note rapid muscle wasting after injury and its restoration with functional electrical stimulation.

Recently there has been renewed interest in functional electrical stimulation to restore walking in paraplegics. The ultimate hope is to dispense with conventional calipers and to provide an effective gait. Functional electrical stimulation prevents muscle wasting and may minimise osteoporosis, but is not applicable when there is a lower motor neurone lesion.

The technique is most useful in the patient with an incomplete motor lesion. Ideally stimulation should be started soon after injury, while the patient is still in bed. If applied to the quadriceps it may enable him to stand without calipers once mobilisation has begun. This use of functional electrical stimulation combined with a more distal application to the peroneal group, with or without an orthosis, can establish gait by bringing about dorsiflexion of the foot and a flexor response to imitate the swing phase during walking.

For a patient with a complete lesion walking presents a much greater challenge but may be possible in selected cases. A graduated daily training programme of isometric contractions to strengthen the quadriceps is required. About three months after the beginning of stimulation standing can usually be started for increasing periods, and once reliable standing has been achieved with external support attempts to restore walking can be made. It is in this type of patient that functional electrical stimulation may have its greatest application, when combined with a reciprocation gait orthosis such as the type designed by the Orthotic Research and Locomotor Assessment Unit at Oswestry or by Douglas at Louisiana State University.

Research has begun on stimulation of forearm muscles to re-establish hand grip in the tetraplegic in cases where tendon transfer surgery may not be possible, but its use is limited because there is often an element of lower motor neurone loss in cervical cord injuries due to anterior horn cell damage.

As yet functional electrical stimulation has not been satisfactorily assessed, and until its long term effects on joints and other physiological responses have been evaluated its use should probably be limited to a few centres.

Prognosis

Age at injury (years)	Life expectancy (years)	Relative mortality rate
	Incomplete tetraplegia	
20	44	2·09×expected mortality rate in normal population
30	36	
40	27	
50	18	
	Complete tetraplegia	
20	30	7·67×expected mortality rate in normal population
30	23	
40	15	
50	9	
	Incomplete paraplegia	
20	46	1·86×expected mortality rate in normal population
30	37	
40	28	
50	19	
	Complete paraplegia	
20	40	3·18×expected mortality rate in normal population
30	32	
40	23	
50	15	

Table adapted from Geisler WO, Jousse AT, Wynne-Jones M, Breithaupt D. Survival in traumatic spinal cord injury. *Paraplegia* 1983;**21**:364-73 and based on calculations made in 1980 by actuarial department of Manufacturers Life Insurance Company, Toronto.

It is important to indicate the likely degree of recovery at an early stage to both patient and relatives, to make planning for the future realistic. The question of financial compensation will often arise in accident cases, and an informed opinion will be required on the degree of functional recovery likely and the effect on life expectancy.

Recovery after a complete cord lesion is far less likely than after an incomplete lesion, but it is unwise to predict non-recovery too early, as some patients with an incomplete injury may initially appear to be totally paralysed because of spinal cord oedema and contusion, which later resolves.

Forecasting the outcome in patients with an incomplete lesion is notoriously difficult. Too optimistic a prognosis may lead to great disappointment with loss of morale and decreased interest in rehabilitation when hopes are unfulfilled. Contrary to a widely held view, however, neurological improvement can be seen later than two years after injury, not only with nerve root and cauda equina lesions but also with cord injuries.

The mortality rate of acutely injured patients managed in a spinal injuries unit is now less than 5%. Death within the first few days is likely to be from respiratory failure, particularly in the high tetraplegic. Multiple injuries, the age, and previous health of the patient all play a part. In patients surviving the period immediately after the injury pulmonary embolism is the commonest cause of death during the acute phase.

With the modern management of spinal cord injury life expectancy has improved over recent years, and as a consequence atherosclerosis and its complications are now a major cause of late death, but renal failure and pressure sores still figure prominently, as does respiratory tract infection in the tetraplegic.

Conclusions

Great progress has been made in the care of patients with spinal cord injuries since the 1940s, when spinal injuries units were first established. There has been a remarkable decrease in complications using the multidisciplinary approach provided by such units, yet some patients are still denied referral. Unless a complete recovery occurs patients should have lifelong hospital outpatient follow up, but with emphasis on continuing care and support in the community.

Although it is right to be optimistic about the future of these patients, their injuries can make a devastating change to their lives. In many cases the injuries need not have happened. For example, a high proportion of road traffic accidents are caused by alcohol consumption, high speeds, and dangerous driving, motorcyclists being particularly vulnerable. Ignorance of the danger of diving into shallow water results in many injuries to the cervical spine. Failure to take simple precautions in the home, such as ensuring that stairs are adequately lit at night for the elderly, may result in falls with cervical hyperextension injuries. Carelessness in contact sports can lead to serious injury. Recognition of this fact has led responsible authorities such as the Rugby Football Union to modify the laws of the game and to issue advice on how it can be made safer.

Finally, those who work with patients with spinal cord injuries are often impressed by the surprisingly high quality of life possible after injury. Many achieve a remarkable degree of independence, earn their own living, choose to marry, have children, and participate fully in family life. They may indeed have special qualities because they have successfully come to terms with their disability, and many will make a valuable contribution to society.

Useful addresses

The Disability Alliance,
25 Denmark Street, London WC2H 8NJ 01 240 0806

Provides advice about welfare benefits

Disabled Living Foundation,
380-384 Harrow Road, London W9 2HU
01 289 6111

An information centre with an extensive display of equipment

Sexual and Personal Relationships of People with a Disability (SPOD),
286 Camden Road, London N7 0BJ 01 607 8851

Deals with sexual problems connected with all types of disability. Helpful series of leaflets

Spinal Injuries Association, Yeoman House,
76 St James's Lane, London N10 3DF 01 444 2121

The association for spinal cord injured people and all involved in their care. Excellent quarterly newsletter

Mr David Grundy, FRCS, is consultant surgeon and Mr John Russell, FRCS, director, Duke of Cornwall Spinal Treatment Centre, Odstock Hospital, Salisbury.

We thank the Department of Medical Photography, Odstock House, Salisbury, and the Department of Medical Illustration, Charing Cross Hospital, London, for the photographs, and Amanda German, Department of Medical Illustration, Charing Cross Hospital for the line drawings.

Further reading

Bedbrook G M. *The care and management of spinal cord injuries*. New York: Springer-Verlag, 1981. A guide to medical management of the spinal cord injured patient.

Bedbrook G M, ed. *Lifetime care of the paraplegic patient*. Edinburgh: Churchill Livingstone, 1985. A comprehensive textbook on the long term aspects of care, written by and for a multidisciplinary team.

Bromley I. *Tetraplegia and paraplegia—a guide for physiotherapists*. 3rd ed. Edinburgh: Churchill Livingstone, 1985. Particularly relevant for therapists with many clear illustrations.

Burke D C, Murray D D. *Handbook of spinal cord medicine*. London: Macmillan, 1975. A pocket book introduction to spinal injuries.

Fallon B. *Able to work*. London: Spinal Injuries Association, 1979. A guide to work and study for the patient with a spinal cord injury.

Fallon B. *So you're paralysed*. London: Spinal Injuries Association, 1975. Written for the newly paralysed patient, but useful for everyone concerned in the long term management of spinal cord injury.

Ford J R, Duckworth B. *Physical management for the quadriplegic patient*. Philadelphia: F A David and Company, 1974. A well illustrated handbook for the occupational therapist.

Rogers M. *Paraplegia—a handbook of practical care and advice*. London: Faber and Faber, 1978. Written from the patient's view point by a tetraplegic.

Treischmann R B. *Spinal cord injuries—psychological, social and vocational adjustment*. New York: Pergamon Press, 1980. The only book devoted exclusively to the psychosocial impact of spinal cord injury on the disabled individual.

Vinken P J, Bruyn G W, eds. *Injuries of the spine and spinal cord*. Amsterdam: North Holland, 1976. (Handbook of Clinical Neurology Series Parts 25 and 26.) A comprehensive and authorative reference book.

Zejdlik C M. *Management of spinal cord injury*. Monterey: Wordsworth Health Sciences Division, 1983. A practical and comprehensive textbook for nurses.

Disability rights handbook. London: Disability Alliance, published anually. Provides information about welfare benefits and the obligations of statutory authorities.