The Development of Physiotherapeutic Intervention with the Head Injured Patient

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Head injury has often been described as the ‘silent epidemic of the twentieth century’, for whilst it is estimated that about one in every three hundred families will be affected by the condition, the public as a whole knows relatively little about it. Furthermore as an increasing number of the more severely brain injured are now surviving due to advances in medical and scientific technology, both the skills and resources of the rehabilitationists are being stretched to new limits.

The physical problems that may result from injury are frequently diverse and complex in their presentation, the situation often being further compounded by cognitive deficits, as well as orthopaedic and respiratory complications. However, in general terms and particularly in the early stages, the problems that pose the most significant obstacles in rehabilitation are due to the presence of abnormal tonus and the development of severe spasticity. These can be summarised broadly as follows:

- Contracture and deformity (fig 1)
- Establishment of abnormal spastic patterns of movement with consequent loss of
- postural control and selectivity
- Myositis Ossificans
- Pain and trauma due to joint mal-alignment and superimposed trauma

In order to control, as far as is possible the development of these problems, therapy has necessarily undergone a significant evolution in recent years. Intervention is now a much more dynamic and positive process and the outcome, therefore, more optimistic.

Some of the more important developments both in philosophy and also therapeutic modality will now be briefly considered.

EARLIER INTERVENTION

As Goldspink reported - dramatic changes occur in muscle tissue when it is immobilised for periods in a shortened position, as would occur in the presence of severe hypertonicity. In particular, there is muscle atrophy, loss of sarcomere numbers, protein degradation and an increase in the proportion of connective to muscle tissue. Significantly, these alterations may start to develop within as little as 72 hours. Furthermore, as Nash highlighted, muscle shortening would seem to potentiate the stretch reflex so that a vicious circle is set up whereby spasticity leads to muscle contracture and muscle contracture in turn increases spasticity.

Certainly contracture and deformity can develop in the head injured with amazing rapidity during the first few days and weeks post-trauma. Although malalignments may establish at any joint, planter flexion contracture of the ankle seems to be the most prevalent with an estimated incidence of about 76%. Loss of normal foot contact with the ground significantly interferes with the ability to stand and transfer weight and will...
ultimately limit mobility (Figs 2 & 3).

The establishment of abnormal mass patterns of movement further interferes with the recovery of function and independence. As highlighted by Kidd, the more these abhorrent synergies are ‘practiced’ the quicker they become learnt and established into the neuronal circuitry of the CNS. Once assimilated, as every Therapist is all too aware, it is extremely difficult to fractionate these mass patterns into their component parts to achieve selective movement and, therefore, ‘choice’ in function. However, if plastic adaptation can be channelled towards normality from the start then the outcome will naturally be more favourable. Consequently, rehabilitation must commence as soon as the patient arrives at the Intensive Care Unit (ICU), and as McMillen, emphasises it must be ‘proactive rather than reactive in its delivery’. Furthermore daily intervention is frequently essential so that the traditional Monday to Friday therapy routine can no longer be regarded as entirely adequate or ethically acceptable in these instances. The extent and severity of the injury are obviously vital factors in determining prognosis, however, as Lynch emphasises the patient is exquisitely sensitive to his, environment and the way in which he is handled and treated. Essentially what happens to the patient in this initial stage may determine the whole nature and quality of his future life.

Therapists in the Royal Hospitals Trust have embraced this concept in a dynamic and committed fashion and are now regarded by many throughout the United Kingdom as leaders in the management of the head injured. The primary benefits of their programme of early intervention can be summarised as follows:
1. A reduction in the incidences of contracture and, therefore, in the numbers of patients later requiring surgery.

2. A reduction in the appearance of myositis ossificans.

3. A reduction in the incidence of painful shoulder.

4. A reduction in the intensity of treatment required following transfer to the sub-acute ward.

**DEVELOPMENT OF NEW THERAPEUTIC INNOVATIONS;**

Over the last two decades in particular many new and exciting therapeutic modalities have been successfully implemented and some of the most influential will now be described.

a) **Dynamic Standing**

The facilitation of selective movements in a weight bearing position to maintain the integrity of the calf musculature and prevent contracture has been advocated by many clinicians. The effect is partly mechanical, but Therapists also exploit the use of proprioceptive input to augment descending inhibitory control, thereby achieving a reduction in tone. The influence on hypertonicity can be so pronounced that patients demonstrating typical severe decorticate posturing may quickly become low toned and easily mobilised so that joint range can be effectively maintained. The effect is most obvious when the procedure is carried out on a more ‘dynamic’ basis, between two or possibly three Therapists, who can adjust their handling appropriately in response to changes in the patient’s level of tonus (Fig 4). Tilt tables may occasionally have to be used, particularly if it is necessary to bring the patient more gradually into the vertical position, however, they hold the patient more ‘statically’ and are consequently less effective in influencing tone. (Fig 5)

Standing of the unconscious ventilated patient in the ICU is even possible providing the cranial pressure and other medical factors permit.

b) **Plastering Techniques**

The use of ‘static’ serial plastering techniques to increase joint range with the head injured as described by Conine and Sullivan, and many others represents a significant development in the management of contracture. (Fig 6) Its use, however, on a prophylactic basis as suggested by Frank, is proving to be even more beneficial. For example, head injured patients in the ICU of the Royal Hospitals Trust now routinely have bilateral plasters applied to maintain their ankles at 90° dorsiflexion, as soon as they begin to demonstrate any increased tone and potential loss of range of movement. Experience has shown that this is best done in conjunction with dynamic standing. In the past surgical lengthening of the tendon Achilles was a relatively common requirement post head injury, however, today largely through the use of both the casts and weight bearing strategies it is rarely necessary.

More recently Therapists have introduced a new form of ‘dynamic’ plastering as described by
Edwards. Essentially, these ‘drop-out casts’ are a less forceful means of regaining joint range allowing some degree of movement as the tone gradually reduces and the limb ‘drops out’ of the cast. They have been found to minimise effectively the problems of joint stiffness and effusion that are so often observed following removal of the static splints, particularly at the elbow and knee. (Fig 7 & 8)

c) Botulinum Toxin

Botulinum toxin is a potent neurotoxin which produces temporary muscle paralysis by presynaptic inhibition of acetylcholine release. It has been used very effectively in the management of dystonia but more recently has played as increasing role in the treatment of severe localised
spasticity in the early head injured patient.

From cases reviewed to date at the Royal Hospitals
Trust the general consensus has been as follows:

- Best results are obtained when the source of the problem can be localised to one or two specific muscles
- The drug is best administered early, i.e. before there is an established or ‘static’ contracture
- The drug is used in conjunction with dynamic plastering techniques
- A back up programme of intensive physiotherapy is implemented following injection in order to maximise the new potential for the recovery of selective muscle function

Generally only one dosage of the botulinum was required in the early stages as the initial severe tonal problems tend to settle to some degree after about six to eight weeks.

It’s use in later stage rehabilitation is currently being explored in various centres and certainly at Joss Cardwell Centre it has proved to be very effective in certain cases where the contracture is of a more dynamic nature. Much more work, however, is required to evaluate objectively it’s efficacy.

d) Specialised Handling Skills

In years gone by rehabilitation was built on the premise that the neuron AI circuitry was a static and fixed entity incapable of change or adaptation. Treatment, therefore, simply encouraged compensatory strategies, i.e. the overuse of unaffected parts, and established spasticity was regarded as an inevitable consequence of brain damage. However, in the last decade or so the dynamic and plastic nature of the CNS has been revealed and its ability to reorganise after damage in respect of both its molecular form and muscle function has been recognised.

Therapists trained in the ‘Bobath Concept’ endeavour to exploit this latent potential, using both their expertise in the analysis of movement and specialised handling skills to direct plastic adaptation towards normality. Treatment essentially involves the inhibition of abhorrent motor activity and the recreation of a framework of balance control and selective movement for functional recovery. This contrasts with certain other approaches which naively see re-education as merely the strengthening of ‘weak’ muscles; a concept which is neither physiologically accurate or clinically effective.

The use of mobilisation and movement etc. to change tone, which is part of the Bobath concept, has to a large extent also superseded the mindless routine of passive movement in the more proactive units. Indeed as reported by Silver and David, although passive movements may have some limited value, when performed overenthusiastically or without proper care to realign the joint (particularly the shoulder girdle), they may be responsible for precipitating myositis ossificans, joint pain and trauma.

HOLISTIC TEAM APPROACH

As highlighted by Cope the diverse and complex problems that characterise head injury necessitate a ‘fully integrated multidisciplinary team approach’.

In the acute stage, for example, appropriate ‘positioning’ of the patient is particularly important as certain postures may actually markedly exacerbate the hypertonicity and thus promote further joint malalignment. Consequently nurse and therapist need to work closely together to use positioning to the patients advantage rather than his detriment. Uniform handling is equally vital in preventing joint trauma and similarly requires the co-operation of all those involved in the patients management.

Furthermore, the needs of the patient and family need to be kept central throughout the whole process of the rehabilitation continuum. At Joss Cardwell Centre the use of the ‘Key Worker’ strategy and case conference format have been successfully introduced whilst the recent implementation of ‘family conferences’ and peer discussion groups etc has greatly enhanced overall effectiveness and patient satisfaction. The importance of the team approach is perhaps best summarised by Nieuwenhuis, who stated that “it is a waste of time putting effort into a rehabilitation programme unless it has the wholehearted cooperation of all the members of staff.”

CONTINUITY AND REVIEW

Unlike stroke - where evidence would seem to suggest that most functional recovery occurs within the first six to twelve months, significant changes in the head injured are well recognised two years or more after
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injury19. Therefore, as Greenwood1 stresses "if recovery is to be maximised rehabilitation may be required for some years after injury".

Recovery of function may also be a relatively discontinuous process characterised by intermittent progress and treatment plateaus, which Bethune20 terms "periods of consolidation". Deterioration may of course also occur if the problems of spasticity have not been effectively controlled. Therefore, as Bach-y-Rita21, suggests episodes of more intensive rehabilitation should be provided to optimise periods of acquisition or indeed to counter any loss of function whilst the consolidation process may require only home management.

This perspective is centred to the philosophy at Joss Cardwell Centre, where fragmentation of responsibility is avoided by an ongoing patient review system led by the Consultant in Rehabilitation Medicine. In this way patients who have been discharged may be re-referred for reassessment or further therapy as deemed necessary.

In conclusion, therefore, whilst it is clear that therapeutic intervention has undergone a considerable metamorphosis in recent years it should also been emphasised that the actual service provision is by no means totally comprehensive. In contrast to the network of NHS Centres for spinal cord injury, even though there are only a few hundred such cases in the United Kingdom annually, service facilities for the head injured are either woefully inadequate or absent. In Northern Ireland, in particular, outside of the immediate Belfast area, many of the young brain injured are merely transferred from acute wards to geriatric units - an utterly deplorable situation for all concerned; the need for a centralised brain injury unit in the province has never been greater.

Therefore, in looking to the year 2000, while we can celebrate advances made, there is ever increasing responsibility to demand more for those shattered by head injury in order to give them a better chance of 'life' rather than mere existence.

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