

REVIEW ARTICLE

STROKE REHABILITATION: EVIDENCE-BASED OR EVIDENCE-TINGED?*

Marion F. Walker

From the Division of Rehabilitation and Ageing, University of Nottingham, Nottingham, UK

The evidence to support stroke rehabilitation has expanded dramatically in the last decade. In order to ensure that the resultant research findings can be generalized to all patients after stroke, research in the next decade must shift to multi-centre trial activity. Published evidence from the stroke unit, early supported discharge and out-patient trials is strong and supports the beneficial effects of these stroke rehabilitation services. Evidence for individual therapeutic practices is continuing to develop, but in many areas further research is required. The benefits of task-specific interventions and the need to practise these with intensity are core findings from the current research literature. Technological and capacity-building advances, along with newly developing stroke research networks, will ensure that the future of stroke rehabilitation is strong and progressing towards becoming truly evidence-based.

Key words: stroke, rehabilitation, research, therapy, evidence.

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Correspondence address: Marion Walker, Associate Professor and Reader in Stroke Rehabilitation, Division of Rehabilitation and Ageing, B Floor, Medical School, Queen's Medical Centre, Nottingham NG7 2UH, UK. E-mail: marion.walker@nottingham.ac.uk

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INTRODUCTION

Multidisciplinary stroke rehabilitation is the cornerstone of high-quality stroke care and the National Clinical Guidelines for Stroke in the UK (1) recommend that it should be offered to every stroke survivor who has the potential to benefit from this service. This paper aims to provide an overview of the available evidence for stroke rehabilitation and will first address the current state of the stroke rehabilitation evidence base. It also aims to provide a balanced interpretation of the evidence for current stroke rehabilitation services and gives some examples of evidence for a range of therapeutic practices up to one year after the onset of stroke. The paper concludes with a view of the future of stroke rehabilitation.

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CURRENT STATE OF STROKE REHABILITATION EVIDENCE

Multidisciplinary undergraduate research training has advanced greatly in the last decades; however, some professional bodies and countries have developed more slowly than others. For example it was not until the mid-1990s that occupational therapy and physiotherapy undergraduate training programmes in the UK progressed from diploma to degree status. Implicit in this shift was the obligation to undertake research training at undergraduate level. Prior to this, however, there were several multidisciplinary stroke rehabilitation research groupings working around the world, but these were led mainly by medical doctors or psychologists and not by therapists. Despite this delayed research culture in the allied health professions, the last decades have witnessed a dramatic increase in the number of active research therapists across the world and many are now principal investigators with their own multidisciplinary programmes of research work. Stroke rehabilitation research is now truly a multidisciplinary led activity.

One must acknowledge, however, that stroke rehabilitation research historically has been a single-centre activity and that there are obvious inherent limitations in conducting this type of research. For instance it is highly likely that individual centres have high levels of expertise in the subject in which they are researching. They may also have unique local settings that make the generalization of research findings difficult to impart to other locations of the country or indeed the world. It is also highly likely that the therapists conducting the research and providing the therapeutic interventions are doing so in part to fulfil their obligations for a higher degree. It could then be argued that these individuals are extremely keen and committed to their project and are prepared to go the "extra mile" required for each patient, and therefore their therapeutic input may not be representative of clinical therapists.

There are many positive findings from single-centre stroke rehabilitation research activity, but if we want our research findings to be implemented by policymakers we need to conduct large trials that are adequately powered, involve multiple centres and have many therapists providing the intervention. Only then will we provide robust evidence that is sufficient to influence policy and change clinical practice. In the interim, where possible, researchers are conducting meta-analyses of available data from single-centre trials in order to provide a balanced interpretation and wider endorsement of the currently available evidence.

No apology should be made for the present state of the rehabilitation evidence base; on the contrary it should be acknowledged that stroke rehabilitation has made substantial advances in a very short space of time.

EVIDENCE FOR STROKE REHABILITATION SERVICES

Organized stroke unit care

It is now universally acknowledged that patients who have been treated in an organized stroke unit rather than on a general medical ward are more likely to be alive, independent and living at home one year after stroke (2). But what is meant by the term organized stroke unit care? If we view the criteria used by the Stroke Unit Trailists systematic review (2), we find that the theme of rehabilitation is a core component of the 4 criteria used: co-ordinated multidisciplinary rehabilitation, staff with a specialist interest in stroke or rehabilitation, routine involvement of carers in the rehabilitation process and regular programmes of education and training. It would therefore appear that rehabilitation is an essential component of the stroke unit success story.

However, organized stroke unit care does not only lead to short-term benefits. A recent study by Drummond and colleagues (3) confirms earlier research findings (4). They showed that up to 10 years after admission to a stroke rehabilitation unit, benefits can still be demonstrated in the areas of death, death or disability and death or institutional care. It would appear that stroke rehabilitation units not only have favourable outcomes up to one year after stroke but also have long-term benefits in survival, functional ability and place of residence. The benefits of stroke rehabilitation as provided in an organized in-patient stroke unit are in no doubt.

Early supported discharge services

In recent years there have been several studies evaluating the benefits of early supported discharge from hospital. A Cochrane systematic review on this topic was published recently in the *Lancet* by Langhorne and colleagues (5) and included 11 trials; all of which aimed to accelerate discharge home from hospital and provide rehabilitation in a home setting.

Three types of services were included in this systematic review: multidisciplinary team co-ordination and delivery, multidisciplinary team co-ordination only, and services where there was no multidisciplinary team co-ordination. The main outcome measure used in this systematic review was death or dependency. In summary, findings indicated that early supported discharge services accelerated discharge home from hospital without compromising functional recovery or causing death. However, it did not seem to be an appropriate service to offer all patients; approximately 40% of patients were deemed suitable to receive early supported discharge services. Although limited data were available for analysis, early supported discharge services did seem to be a viable cost option and better results were demonstrated for patients who had received co-ordinated rehabilitation. This systematic

review also demonstrated benefits for patients who had a mild to moderate deficit following stroke.

Outpatient stroke rehabilitation services

Another Cochrane systematic review was conducted to assess the effects of therapy-based rehabilitation services targeted towards patients resident in the community within one year of stroke onset (6). This systematic review included data from 14 trials and 1617 patients. Trials of occupational therapy, physiotherapy and mixed services were included in the systematic review. The review was also published in the *Lancet* (7) and concluded that patients receiving stroke rehabilitation services in the first year after stroke were more likely to have a better outcome, in terms of independence and achievement of maximum level of function in all aspects of daily life. It would seem, therefore, that patients after stroke who received out-patient stroke rehabilitation services were more likely to be able to perform both personal activities of daily living, such as washing, dressing and feeding, and more extended activities of daily living, such as crossing roads, making meals and domestic chores, than patients who did not receive this service.

A further individual patient data meta-analysis has been conducted on occupational therapy trials (8) that provided interventions to patients after stroke in their own homes up to one year after the onset of stroke. Again, positive benefits in terms of extended activities of daily living were demonstrated for patients who received this service compared with patients who did not. Better outcomes were also found for patients who received targeted occupational therapy interventions.

EVIDENCE FOR SPECIFIC THERAPEUTIC INTERVENTIONS

Outdoor mobility

A recent paper by Logan et al. (9) documented that 42% of patients after stroke do not go out of the house as much as they would like. The reasons given for this activity restriction were: lack of relevant information to help them achieve outdoor mobility, physical limitations imposed following stroke, and fear of falling. This finding therefore led to a pragmatic randomized controlled trial evaluating an outdoor mobility programme (10). The trial included 168 participants from 17 primary care trusts. Each patient received a 60 minute mobility assessment and a pack of written mobility information. Patients were then allocated randomly to the outdoor mobility programme or to a conventional care group.

The activities provided in the mobility programme reflected the goals set jointly by the patient and therapist (11). The most common activity patients wanted to achieve was to walk outside their home. Other popular goals included; to be able to catch the local bus, to be more competent in using their scooter, to drive their car or to use a taxi. Several people also simply wanted to be a passenger in their spouse's car whereby they could be taken for a drive, thus making a journey solely for pleasure. Interventions were targeted at building up the

individual's confidence and promoting outdoor mobility (11). A mean of 6 visits, of approximately one hour duration, were provided.

The findings from this trial demonstrated that individuals who had been recruited to the mobility programme had significantly higher scores in the mobility section of the Nottingham Extended Activities of Daily Living (12) assessment, than if they had been randomly allocated to routine care. Individuals also took more than double the number of journeys and most importantly they felt they could get out of the house as often as they wished to do so. This study therefore produced clinically meaningful results in a relatively short treatment period by providing a targeted intervention directed towards a specific activity limitation. A large multicentre study is now required to assess whether these findings can be replicated in other geographical areas.

Dressing

The ability to dress oneself after stroke is a complex process. It is therefore not surprising that 36% of patients after stroke still cannot dress themselves independently 2 years after the onset of stroke. However a cross-over randomized controlled trial (13) conducted more than 10 years ago, demonstrated that by teaching simple problem-solving skills, 75% of patients could improve their dressing scores as measured on the Nottingham Stroke Dressing Assessment (14). This study also demonstrated that 33% of patients became independent in dressing following the 6-week intervention. Due to the cross-over design of the study, effects could still be seen 3 months after treatment finished. However, it must be noted that patients who became independent appeared to have little cognitive difficulties. Several years later a further study (15) was conducted with patients after stroke with persistent dressing difficulties and accompanying cognitive difficulties. A series of single case designs were conducted to test if tailored interventions formulated by the combination of a detailed dressing observation, findings informed from detailed cognitive testing and evidence from the literature could influence the ability to dress independently. Findings indicated that there was some impact on dressing independence for right hemisphere cases, but no therapy-related improvement was found for left hemisphere or bilateral cases. This study would suggest that there may be some promising indications for rehabilitation interventions into this common problem after stroke but that further research is necessary.

Equipment

Equipment is commonly provided during stroke rehabilitation, but despite this there has been surprisingly little research conducted in this area. The evidence for equipment provision is largely secondary, derived from observations in randomized controlled trials or from surveys (1).

Researchers have found that patients after stroke are more likely to be in possession of equipment to aid independence and were more likely to be using the equipment one year after stroke if they had been treated on a stroke unit (16). Other researchers have documented that 47% of patients do not use

the equipment they have been supplied with (17), which may reflect inappropriate provision or inadequate training in how to use it.

One of the strongest indications for the provision of equipment in the stroke literature comes from the secondary findings of Logan et al. (18), who found that patients who had received treatment from an enhanced social occupational therapy service were more likely to have more equipment to aid independence than if randomly allocated to routine social service care. The most commonly provided piece of equipment was a second stair rail at a cost of approximately £40. The benefits of the provision of a second stair rail appeared to be reflected in significantly higher numbers of patients who could climb stairs independently as reported in the Barthel Index (19). This finding may be of major clinical importance for many survivors of stroke and can be provided at a relatively small cost. However, more research will be required in this field to provide guidance on appropriateness of equipment provision, training and compliance with equipment for patients after stroke.

KEY MESSAGES IN THE STROKE LITERATURE

One of the strong messages in the recent stroke literature is that rehabilitation needs to be task specific. Task-related training is the repeated use of active sequences of functional movement. This paper has already provided specific examples of task-related training in mobility and dressing, but there is also an increasing amount of evidence in others areas to support this type of intervention, such as motor practice.

A particular landmark study in the area of motor practice was conducted by Feys et al. (20), who recruited 100 patients and allocated them randomly to treatment in a rocking chair with the affected arm in an inflatable splint in 80% flexion and slight abduction, or to treatment in a rocking chair, hand in lap with short-wave diathermy to the shoulder. Each patient received their randomly allocated intervention for 30 minutes per weekday for a 6-week period. A greater improvement in functional ability and motor function was found for those allocated to the rocking chair with their arm in an inflatable splint. The benefits seen in this study were found not only at one year (20) after randomization, but also 5 years later (21).

Another key message from the stroke literature informs us that intensity of therapeutic interventions have positive benefits. Kwakkel et al. (22) conducted a systematic review of the literature investigating the effects of augmented therapy time. This systematic review included 20 trials and found a small but significant effect in activities of daily living function at 6 months after stroke. No ceiling effect was found for level of intensity. This systematic review therefore informed the Royal College of Physicians' National Clinical Guidelines for Stroke (1) that patients should be given the opportunity repeatedly to practice functional skills and activities. The challenge now posed for stroke rehabilitation services is how to implement additional therapeutic input in the current climate of staff shortages and healthcare cost restrictions.

THE FUTURE OF STROKE REHABILITATION

Earlier sections of this paper have demonstrated that stroke rehabilitation services can be effective and that we are beginning to have a better understanding of the individual components of stroke rehabilitation practices. However, many of these individual areas require further research and there are many more additional stroke rehabilitation questions that need to be addressed. For example, how soon can a patient use a wheelchair? How early after stroke should we mobilize patients? What are the benefits of pre-discharge home visits? What are the skills of the "successful" stroke therapist? Can these skills be taught to junior stroke therapists or is therapeutic success purely a product of the therapist's personality?

There are also many exciting technological developments in stroke rehabilitation at the present time that need further evaluation. The emerging evidence base in the fields of robotics, virtual reality and tele-rehabilitation are all exciting developments. Another innovative area in stroke rehabilitation is the synergistic combination of rehabilitation and pharmacological agents. There is evidence to suggest that there may be some benefit in the use of piracetam and speech and language therapy; however, more research is needed to determine the actual benefit and possible risk of adverse effects of using this drug (23). Similar studies have been carried out with the use of amphetamine drugs (24) but, again, more research is needed if we are to fully understand the possible benefits of using this drug in combination with stroke rehabilitation.

An exciting development in the UK has been the formation of the UK Stroke Research Network (www.uksrn.ac.uk). The Department of Health has recently dedicated £20 million over a 5-year period to fund this initiative. The Stroke Research Network has been established to provide research infrastructure across the UK and rehabilitation is one of 4 targeted areas for future development. It is hoped that the network will allow stroke rehabilitation to further expand and strengthen existing expertise. Training will be available to therapists who may not have the necessary research skills and knowledge, but are keen to be involved in on-going network adopted research projects. The network will provide the infrastructure to facilitate rehabilitation trials across the 8 newly appointed local research networks, thereby increasing the generalizability of the trial findings.

BUILDING RESEARCH CAPACITY

Across the world we are continuing to develop stroke rehabilitation research capacity. In the UK, Career Scientist Awards previously only available to medical personnel are now available to members of the allied health professions. The Department of Health has also committed to the creation of 250 therapy consultant posts. Although these consultant posts have a large clinical commitment, one of their key roles is to initiate and develop research at a local level. It is therefore hoped these new positions will prove to be a crucial component in building research programmes in the therapy professions.

CONCLUSION

The evidence for stroke rehabilitation has expanded greatly in the last decade and is advancing towards a truly evidence-based service. There has been an exponential increase in the number of stroke rehabilitation research projects and publications and many researchers are now leading stroke programmes throughout the world. We have a strong evidence-base to underpin stroke rehabilitation services and we also have increasing levels of evidence and a better understanding of our individual therapeutic practices. It is imperative that we do not become complacent about our recent successes because much more research is needed if we want to provide a truly evidence-based service to stroke survivors. However, one would doubt that such complacency is likely as there has never been a more exciting time to be involved in stroke rehabilitation research.

At the present time we have a duty to provide our patients with the best possible stroke rehabilitation services and interventions, but we must never forget that we also owe our patients of the future the opportunity to benefit from our continuing research enquiries.

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