Rehabilitation therapy services for stroke patients living at home: systematic review of randomised trials

*Outpatient Service Trialists**

Summary

Background Stroke-unit care can be valuable for stroke patients in hospital, but effectiveness of outpatient care is less certain. We aimed to assess the effects of therapy-based rehabilitation services targeted at stroke patients resident in the community within 1 year of stroke onset or discharge from hospital.

Methods We did a systematic review of randomised trials of outpatient services, including physiotherapy, occupational therapy, and multidisciplinary teams. We used Cochrane collaboration methodology.

Findings We identified a heterogeneous group of 14 trials (1617 patients). Therapy-based rehabilitation services for stroke patients living at home reduced the odds of deteriorating in personal activities of daily living (odds ratio 0·72 [95% CI 0·57–0·92], p=0·009) and increased ability of patients to do personal activities of daily living (standardised mean difference 0·14 [95% CI 0·02–0·25], p=0·02). For every 100 stroke patients resident in the community receiving therapy-based rehabilitation services, seven (95% CI 2–11) would not deteriorate.

Interpretation Therapy-based rehabilitation services targeted at selected patients resident in the community after stroke improve ability to undertake personal activities of daily living and reduce risk of deterioration in ability. These findings should be considered in future service planning.

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Introduction

Stroke is a major health-care challenge, especially in the developed world, where it is one of the most frequent causes of disability and accounts for considerable costs for health and social services.[1] Organised inpatient care in multidisciplinary stroke units can reduce these adverse outcomes compared with less organised inpatient care.[2] However, there is not much consensus about the effects of rehabilitation services for stroke patients once they have left hospital. This omission is important, because patients returning home after a stroke sometimes lose some of their independence.[3] Furthermore, such services are recommended in UK Government documents and are valued by patients and carers, but provision is inconsistent.[4–6]

We aimed to review evidence that rehabilitation services for stroke patients who had returned home could affect their recovery. We restricted definition of services to those provided by physiotherapists, occupational therapists, or multidisciplinary teams. We then aimed to do a systematic review to test the null hypothesis that such services do not affect recovery of patients living at home after a stroke.

Methods

Procedures

We included any randomised controlled trial that compared an outpatient therapy-based rehabilitation service with no routine input. We classified these services as interventions provided by qualified physiotherapists, occupational therapists, or multidisciplinary staff, or under the supervision of qualified therapy staff. This definition was developed from a previous descriptive analysis of rehabilitation services, which indicated that these services had a consistent approach to reduction of disability by improvement of task-oriented behaviour—eg, walking, dressing.[7] Participants in these trials were living at home within 1 year of stroke onset or hospital discharge. We chose outcomes of interest to represent the full burden of disabling illness and the probable target of therapy-based rehabilitation interventions. The primary outcome of interest was extent to which therapy-based rehabilitation services could affect a patient's risk of deterioration. We defined this outcome as deterioration in ability of a patient to undertake activities of daily living or a patient becoming dependent in activities of daily living by the end of scheduled follow-up (ADL score). Deaths were included as deterioration. Secondary outcomes were case fatality, need for long-term institutional care, ability to undertake extended activities of daily living, patient's mood and quality of life, carer's mood and quality of life, and resource use—eg, re-admission.

We used the search strategy developed for the Stroke Group of the Cochrane collaboration.[8] We searched the

	N	Age (mean, years)	Men	Methods used	Intervention			Control service	Follow-up (months)
					Type	Duration	Number of contacts		
Multidisciplinary team (MDT)									
Hong Kong[14]	120	73·5	44%	C, b	MDT based in a day hospital*	Variable	Variable	Medical clinic	6
London[16]	133	65	66%	c, B	Outpatient input from MDT	12 weeks	4 per week	Health visitor	12
Philadelphia[21]	55	72 (median)	51%	c, B	Home-based MDT input	12 months	Variable	NRI	12
South London[22]	43	74	42%	C, B	Home-based MDT rehabilitation programme	<12 weeks	Variable	NRI	12
Physiotherapy (PT)									
Copenhagen[12]	101	71	47%	C, b	Domiciliary PT input†	6 weeks	..	NRI	6
Kansas[15]	20	68	..	C, B	Domiciliary PT programme	8 weeks	3 per week	NRI	3
Occupational therapy (OT)									
Cardiff[11]	110	75·5	37%	C, B	OT input at home or residential home	24 weeks	4	NRI	12
Glasgow[13]	138	69 (median)	45%	C, B	OT input at home post-discharge	6 weeks	10	NRI	6
Nottingham, 1995[17]	65	66	57%	C, B	Leisure-based or ADL-based OT input	26 weeks	10	NRI	6
Nottingham, 1996[18]‡	30	68	53%	C, B	Home-based OT to improve dressing	12 weeks	Variable	NRI	3
Nottingham, 1997[19]	111	55	43%	C, B	Enhanced OT service provided by social services	<12 weeks	Variable	Usual care	6
Nottingham, 1999[20]	185	74	51%	C, B	OT input for patients not admitted to hospital	Variable	6	NRI	6
TOTAL[23]	466	72 (median)	58%	C, B	Leisure-based or ADL-based OT input	26 weeks	10	NRI	12
Vancouver[24]	40	69	67%	c, B	OT input to restore leisure activities	5 weeks	5	Attention controls	4

N=number of patients. ADL=activities of daily living. C=definite concealment of allocation. c=unclear. B=definite masking of follow-up. b=unclear. NRI=no routine intervention/usual care. *Two intervention groups. †Excluded doctor-based intervention. ‡Cross-over trial, first phase only used.

Characteristics of included trials

Cochrane Controlled Trials Register (Cochrane Library 2001, issue 4) and electronic bibliographic databases including MEDLINE, CINAHL, PsycLIT, EMBASE, AMED, Social Science Citation Index, and Science Citation Index. To ensure that we identified all potentially relevant trials, we also scanned reference lists of articles and original papers, spoke to colleagues, and searched journals by hand. One of us (LL) looked at the titles of all references identified and eliminated any obviously irrelevant studies—eg, pharmacological or surgical interventions, or study designs other than randomised trials. We obtained abstracts of the remaining studies, and two of us (LL and PL) assessed them for inclusion. We resolved by consensus any differences of opinion about trial eligibility. Trial searching was completed in November, 2001.

Two reviewers (LL and PL) independently rated the methodological quality of studies with recognised criteria:[9] method of generating the random sequence, concealment of treatment allocation, masking of outcome assessment, and presence of an intention-to-treat analysis. Our primary aim was to obtain standardised data through collaboration with the original trialists. When data were taken from published sources, these were extracted by two independent reviewers (LL and PL) with a standard data recording form.

Statistical analysis

We analysed binary outcomes with a fixed effects model, as odds ratios with 95% CIs. For continuous outcomes, we used a random effects model to take account of statistical heterogeneity. To assess the effect of the method of randomisation, presence of an intention-to-treat analysis, and masking of final outcome assessment, we did sensitivity analyses. We used Review Manager software, version 4.1 (Cochrane Collaboration, Oxford, UK).

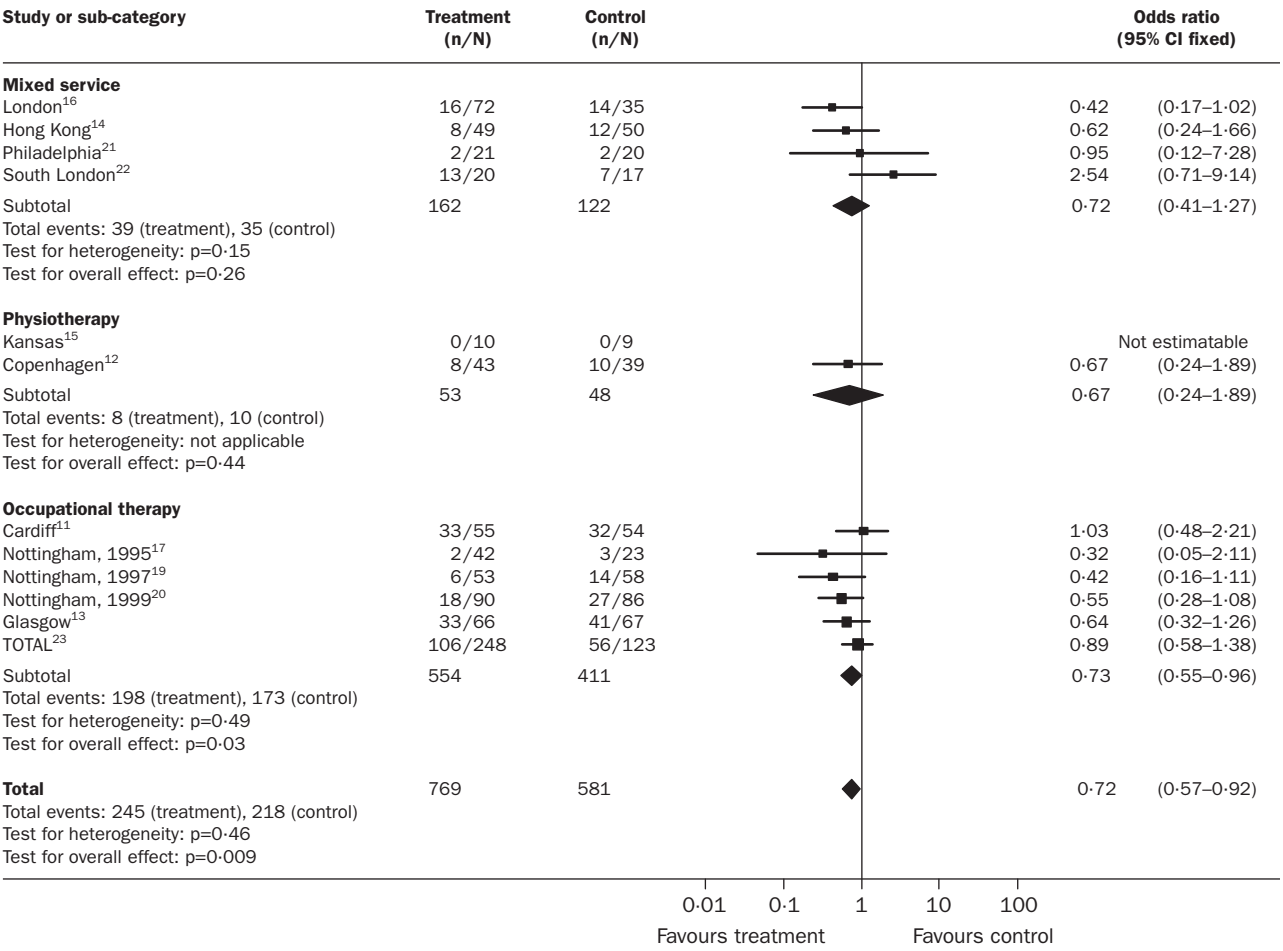
Role of the funding source

The sponsors of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

4946 references were screened, of which most could be excluded from the title alone. Of 27 trials selected for assessment, ten were excluded. Reasons for exclusion included trials of early discharge services (comparison of inpatient and outpatient services; n=2), inappropriate intervention (4), late intervention (3), and insufficient numbers of stroke patients (1); further details are presented in the Cochrane Library version of this review.[10] Three trials were not yet completed. The remaining 14 trials[11–24] contained information on a total of 1617 patients. Individual patient data were gathered for: Kansas, USA[15]; Cardiff, UK;[11] Glasgow, UK;[13] Nottingham, UK (for 1995,[17] 1996,[18] 1997,[19] and 1999);[20] TOTAL (UK-based);[23] and Vancouver, Canada.[24] Aggregate data were obtained for: Hong Kong, People's Republic of China;[14] London, UK;[16] Philadelphia, USA;[21] south London, UK;[22] and Copenhagen, Denmark.[12]

Mean age of patients in the 14 studies ranged from 55 to 75·5 years, and mean age across studies was 70 years. The sex ratio was generally balanced. Baseline Barthel index scores were available for eight trials,[11–15,20,22,23] and these suggested that patients were of mild to moderate disability (Barthel index 14–18 of 20 points). Reasons for exclusion of patients in these trials included history of stroke;[14] various degrees of communication, or cognitive or other co-existing disorders that would interfere with adherence or outcome assessment;[12,13,15,17,21,23,24] inability to speak English;[13,17,18,20,23] discharge to a residential or nursing home;[12,13,20,21,23] or absence of a carer who was willing to participate.[21,24] In two studies, patients were recruited who had never been admitted to hospital,[20,22] whereas in the other 12 studies,



Effects of therapy-based rehabilitation services on poor outcome

Results are presented as number (n) of patients who deteriorated (of a total N) with odds ratio (95% CI) of deterioration.

patients had received some form of hospital care before recruitment.[11–19,21,23,24]

Four trials compared two alternative forms of intervention against usual care or no routine intervention.[12,16,17,23] Two trials compared alternative forms of occupational therapy against no routine intervention;[17,23] one trial compared three different intensities of therapy; another trial[12] compared a therapy-based physiotherapy intervention with a doctor-based intervention against usual care. Because our review was confined to therapy-based interventions, the doctor-based intervention was excluded. One trial used a crossover design in which patients were given dressing practice, the intervention of interest, in sequence.[18] For our review, end of scheduled follow-up is end of first treatment period—ie, 12 weeks. The remaining nine trials compared the intervention of interest with either usual care or control.[11,13–15,19–22,24] The table shows a summary of comparisons made and intensity of intervention.

In 11 trials, a concealed randomisation procedure was clearly described.[11–15,17–20,22,23] In 12 trials, an unequivocally masked final outcome assessment was used for all patients.[11,13,15–24] Median time to follow-up was 6 months (IQR 6–12). In total, 138 (9%) of 1617 patients were lost to follow-up. The table shows a summary of the methodological characteristics of the studies.

One of the primary outcomes was deterioration of patients' ability to undertake activities of daily living (figure). In six trials (549/1617 patients; 34%), data for change in ADL score were reported;[11–16] odds of deterioration in the group receiving therapy-based rehabilitation services fell (odds ratio 0·67 [95% CI 0·46–0·97]; p=0·03). No significant heterogeneity was noted between trials (p=0·67). When a re-analysis was done, including trials that recorded only dependency at the end of follow-up, outcomes were available for 1350 (83%) of 1617 patients from 12 trials.[11–17,19–23] Odds of deterioration were closely similar (0·72 [0·57–0·92]; p=0·009), with no heterogeneity between trials (p=0·46). The overall event rate for controls was 37·5% (218 of 581), which combined with an odds ratio of 0·72 gives an estimated number needed to treat of 14 (95% CI 9–52). The absolute reduction in risk of deterioration in ability to undertake activities of daily living was seven per 100 patients allocated therapy-based rehabilitation.

Odds of a poor outcome were unchanged when the analysis was restricted to ten trials (1202/1617 patients; 74%) with clear randomisation procedures and masking (odds ratio 0·75 [95% CI 0·58–0·97]; p=0·01).[11–15,17,19,20,22,23] If patients who were missing from the treatment (112/881; 13%) and control (85/666; 13%) groups were assumed to be alive and have no deterioration, then odds of a poor outcome were still significantly reduced for patients receiving therapy-based rehabilitation services (0·77 [0·61–0·97]; p=0·03).

The second primary outcome was dependence in ADL score at the end of follow-up, which could be measured in 1180 (73%) patients from 12 trials.[11–16,18–23] Standardised

mean difference was 0·14 (95% CI 0·02–0·25; p=0·02), and no significant heterogeneity was reported between trials (p=0·49), indicating improved ADL scores in intervention group survivors. The estimated standardised mean difference of 0·14 would be about equivalent to a one point (5%) difference in the Barthel index (assuming a population SD of 7 points).

Data for extended activities of daily living were available for 996 (62%) of 1617 patients randomised in nine trials.[11–13,15,17,19–21,23] The standardised mean difference was 0·17 (95% CI 0·04–0·30; p=0·01), indicating a significant improvement in extended activities of daily living. Data were incomplete (available for fewer than 50% of patients randomised) and inconclusive for the outcomes of mood, quality of life, hospital re-admission, and need for long-term institutional care.

Discussion

We have shown that therapy-based rehabilitation services for individuals living at home after stroke can reduce risk of deterioration in ability to undertake activities of daily living. In general, this conclusion is secure: our search strategy was comprehensive, quality of trials was good, and we obtained additional detailed unpublished information from trialists. From a funnel plot and sensitivity analyses, we recorded no evidence of significant publication bias (data available from authors); exclusion of trials with a high risk of bias did not alter our conclusions.

However, our analysis has potential limitations. Rehabilitation trials can have methodological limitations, such as difficulty in masking patients and therapists, and potential for contamination between groups. In our analysis, these risks were reduced by patients being treated in relative isolation at home. Furthermore, key methodological criteria known to affect trial outcome were met in most studies.[9] The trials we included with rigorous design could have underestimated the effect of interventions because the full effect of a complex intervention such as rehabilitation is dependent on all other necessary conditions for success being met—a situation that is not always achieved in research settings.[25]

One further challenging area is that of comparability of interventions. Three types of therapy-based rehabilitation service for stroke patients living at home have been included in this review. These services were provided by physiotherapy staff, occupational therapy staff, or a multidisciplinary team. Characteristics of the therapy-based rehabilitation services assessed varied both across and within groups. This clinical heterogeneity raises the question of trial compatibility. However, the common feature of all these studies is that they aimed to improve activity by altering task-associated behaviour,[7] which justifies our decision to analyse them in this way. Nevertheless, we cannot exclude the possibility that the different groups of interventions might differ in their effects. It is noteworthy that, with the exception of one trial,[19] all therapy-based rehabilitation interventions were managed from or through hospitals by staff that had a specific interest in, knowledge of, and responsibility for stroke care.

Our results suggest that a therapy-based rehabilitation service could be beneficial. Although the health gain we recorded is fairly modest, we know of no other intervention at present that can provide this increase at this stage of recovery. The exact nature and content of therapy-based rehabilitation services is not answered by our review; neither is the most effective way to structure provision of these services, nor their economic benefits. What does seem clear is that the debate should move from whether such services are effective to how to make the most of their benefits.

Contributors

L Legg was lead reviewer and produced the first draft of the paper. P Langhorne planned the review and edited the paper. Both collaborated on the final version before initial submission and took responsibility for the submitted version of the paper. The following members of the Outpatient Service Trialists group obtained primary data and assisted in the editing of the paper: H E Andersen; S Corr; A Drummond; P Duncan; A Gershkoff; L Gilbertson; J Gladman; E Hui; L Jongbloed; J Leonardi-Bee; P Logan; T Meade; R de Vet; J Stoker-Yates; K Tilling; M Walker; and C Wolfe.

Conflict of interest statement

None declared.

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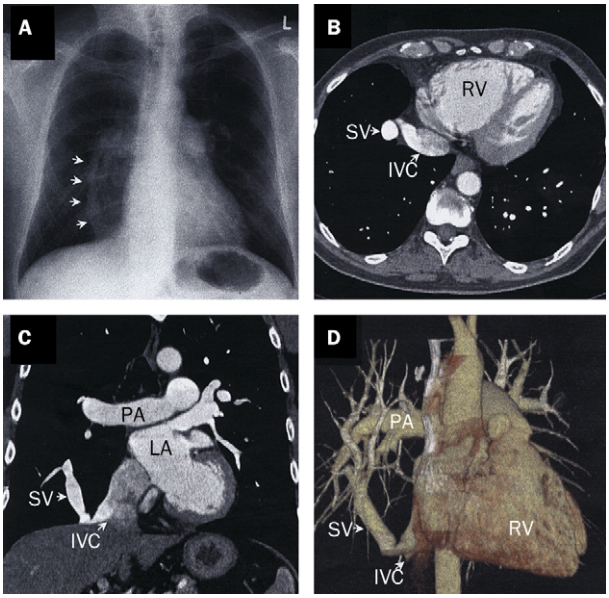
Clinical picture

Scimitar syndrome

M Riedel, J Hausleiter, S Martinoff

A 66-year-old man presented with a non-resolving right lower lobe infiltrate. The chest radiograph showed prominent central pulmonary arteries (PA) with normal tapering into the periphery and a typical scimitar-shaped shadow in the right lung (figure A, arrows). On auscultation we heard a soft systolic ejection murmur over the pulmonic area and a soft mid-diastolic flow murmur at lower sternum, suggesting a left-to-right shunt. Echocardiography showed a dilated right ventricle (RV) with normal kinetics and a systolic pressure gradient between the right ventricle and atrium of 25 mm Hg. We excluded an atrial septal defect. The left ventricle and all heart valves were normal. Contrast-enhanced electrocardiogram-triggered ultrafast multi-slice CT showed a dilated pulmonary artery (trunk diameter 36 mm), dilated RV and the scimitar vein (SV) at the level of its confluence with the inferior vena cava (IVC) (figure B). In the coronal plane (figure C), the anomalous SV could be visualised in its entire course to the IVC; the picture also shows the dilated PA. The three-dimensional image reconstructed from the CT (figure D) showed that nearly all venous return from the right lung was directed via the anomalous SV to the IVC just above the diaphragm. The left pulmonary veins drained normally into the left atrium (LA). At catheterisation, a left-to-right shunt ratio of 48% due to the anomalous pulmonary venous drainage through the SV was confirmed. Corrective surgery (redirecting the scimitar vein into the left atrium) was not done in our patient because he had no symptoms, no coexistent cardiovascular anomalies or pulmonary hypertension, and a low shunt ratio.



The scimitar syndrome is a congenital anomalous connection of the pulmonary vein with the inferior vena cava. On the chest radiograph, the vein produces a vascular shadow to the right of the heart that descends toward the diaphragm, resembling a scimitar, which is a short curved Turkish sword. In the adult, it is most often a benign anomaly usually discovered as an incidental finding. The scimitar syndrome should be considered in the presence of an atypical right paracardial shadow on the posteroanterior chest radiograph; contrast-enhanced CT with 3-dimensional reconstruction establishes the diagnosis.

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