Early Supported Discharge Following Stroke Improves Health Outcomes and Reduces Length of Stay Compared to Inpatient Rehabilitation in an Australian Clinical Setting

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Abstract

Background: Early Supported Discharge (ESD) programs are a proven best evidence model of care following stroke but are yet to be evaluated within the context of Australian clinical practice.

Objective: To compare functional outcome, quality of life, carer stress and length of stay in patients admitted to an ESD program with those receiving inpatient rehabilitation after admission for an acute ischemic stroke.

Method: Seven outcome measures were taken during the initial hospital admission for acute stroke and at six weeks post stroke admission: Functional Independence Measure (FIM), Berg Balance, National Institutes of Health Stroke Scale (NIHSS), Modified Rankin Scale (mRS), European Quality of Life-5Dimensions (EQ-5D), Carer Stress and length of stay (LOS).

Results: A total of 37 participants (23 males), mean age 70.9 years (SD 14.8), participated in the study. The ESD group (n=19) had a significantly shorter LOS by a mean of 4.6 days (p<0.001), significantly higher quality of life (mean 89.9 vs 69.5, p<0.001) with no significant impact on carer stress (p = 0.31).

There was a significant effect of time for the FIM, Berg Balance, mRS and NIHSS (all p<0.001). Patients in the ESD group demonstrated end of study Berg Balance mean score of 53.7 (p=0.01) and mRS (p=0.01) relative to those receiving inpatient rehabilitation indicative of greater improvements in the ESD group.

Conclusion: An ESD service can accelerate discharge to home and increase independence compared to inpatient rehabilitation in the context of Australian clinical practice.

INTRODUCTION

Stroke is one of the world’s leading causes of death and disability [1]. The cost of stroke care is considerable, whether measured in health care dollars spent or the social impact on families and carers [2,3]. Currently the prevalence of lifetime cost for stroke in Australia is estimated to be AU$1.3b. The most significant costs occur during the first year post stroke and are associated with acute hospitalisation ($154m) and inpatient rehabilitation (AU$150m) [4]. Determining the most effective ways to organise health services for patients after stroke remains of critical importance to improve patient outcomes and reduce the burden of cost.

For patients with acute stroke, several trials [5,6] have demonstrated that organized care in an acute stroke unit improves outcome indices such as living at home at 12months [5], promotes higher levels of independence and reduces acute hospital length of stay (LOS) [6].

Following the acute phase, people with stroke have traditionally received a substantial part of their rehabilitation in hospitals or in an inpatient rehabilitation facility. This is known as inpatient rehabilitation (IPR). The late 1990’s saw a move towards more innovative models of care in which people following stroke were discharged earlier and received rehabilitation and support within the home environment, otherwise known as an Early Supported Discharge (ESD) program [7].

A Cochrane Review (2012) [8], identified 14 randomized controlled trials comparing “conventional care” (i.e. IPR) with “rehabilitation and support” provided in a community setting (i.e. ESD). The aim of the review was to investigate which model of care reduced the duration of hospital care. The authors found that ESD...
programs reduced LOS by an average of seven days and reduced long term dependency at 12 months follow-up (odds ratio 0.80; 95%CI 0.67 to 0.97, \( p=0.02 \)) [8]. The authors recommended that the ESD model be implemented in different health care settings such as in a rural environment and extended to those classified as within the mild to moderate stroke population (NIHSS > 8). In addition, while highly structured randomized controlled trials are the most appropriate form of research to provide information on efficacy, evaluation of more pragmatic programs is beneficial to determine whether the best evidence of highly structured trials apply when translated into clinical practice. Fisher et al., (2015) compared the effects of ESD with usual care in clinical practice in a quasi-experimental study in the United Kingdom [9]. The study demonstrated that benefits associated with ESD including reduced length of stay and improved functional outcomes were consistent with those found in clinical research trials. These findings suggest that rehabilitation in the home environment may provide a more stimulating, challenging and contextually appropriate place for rehabilitation, which in turn promotes more activity and improvements in activities of daily living function. It was proposed that at home, the familiar surroundings may increase patient confidence to participate in interventions resulting in more independence and indirect therapy. To date, this is the only study to evaluate ESD after stroke outside the confines of a clinical trial and no such evaluation has taken place in Australia. The viability of the study within an Australian setting therefore needs to be investigated to ensure such a program can be effective at improving functional outcomes and provide a safe home environment for rehabilitation to take place despite the significantly less support services available to carers compared to current United Kingdom models of ESD programs.

In 2013-2014, Sydney’s Royal North Shore Hospital (RNSH) admitted 325 patients with stroke, accounting for 2,872 bed days. LOS on the neurology ward was variable and largely dependent on the extent of neurological deficits and availability of discharge destination. On average, patients with less severe deficits were able to be discharged directly home without requiring further rehabilitation and had a mean hospital length of stay of 7.4 days. In comparison, that more affected requiring inpatient rehabilitation (IPR) waited a mean of 13.7 days for a bed to become available. In this cohort, patients ultimately participating in IPR spent valuable rehabilitation time waiting for a rehabilitation bed and transfer to a rehabilitation unit to become available which was largely dependent on unit capacity. In the context of this study, local non-specific stroke rehabilitation services available to RNSH such as traditional outpatient physiotherapy or home based rehabilitation also have waiting lists of approximately four weeks for an initial assessment. When reviewing referral destinations and models of care for the 325 patients admitted to RNSH in 2013/2014 with an acute stroke, 12% (44/325) were accepted into IPR. This was associated with an approximately 100% increase LOS relative to those without inpatient rehabilitation needs, accounting for 277 extra acute bed days (AU$880/acute stroke bed).

Aim

The aim of the current study was to compare the outcomes of patients with an acute ischemic stroke receiving an ESD program to patients receiving IPR in an existing stroke service in Sydney, Australia. We hypothesized that functional outcome, quality of life, carer stress and length of stay will be reduced in the ESD group intervention compared to the IPR group intervention.

Methods

This study was a non-randomized controlled trial. Pre-test and post-test measurements were taken of both groups. The study was undertaken between February 2014 and June 2015. All patients with stroke admitted to the acute stroke unit were considered if they met the inclusion criteria for ESD (described below). Ethics approval was granted by the local Human Research Ethics Committee, and all participants provided written informed consent. Upon providing consent to participate in the study, participants were then given the option to participate in ESD (intervention group) or IPR (control group). This study took place at RNSH, a large hospital in metropolitan Sydney, Australia.

Study participants and recruitment

The ESD team screened all patients admitted to RNSH during the study period with a clinical definition of an ischemic stroke within 72 hours of admission. Stroke was defined as an acute focal neurological deficit caused by cerebrovascular disease and obstruction within a blood vessel supplying blood to the brain [10]. The ESD team consisted of a physiotherapist, occupational therapist, nurse, speech therapist, social worker and dietician. Eligibility criteria for the ESD program were: 1) admission with acute ischemic stroke as determined by Magnetic Resonance Imaging, 2) patient assessed as medically stable to be enrolled in the Early Supported Discharge program, 3) required no more than one assist with mobility, 4) supported by a carer at home, 5) lived within the geographical region covered by the health service, and 6) aged 18 years or older, 7) received no tPA and had no reperfusion Potential participants were ineligible if 1) they were highly dependent or had severe dementia, 2) had a terminal illness with life expectancy expected to be less than 12 months, 3) were living in residential care prior to admission. This process allowed identification of participants suitable for an ESD program early in the acute care phase of the patient’s clinical pathway.

Patients meeting eligibility criteria and their families were approached on the acute ward by the principal investing at or during their acute admission and were provided with written information detailing the study program. They were then given 24 hours to consider consent, after which those who consented chose either the ESD or IPR intervention. Assignment was not randomized but based on patient preference and the level of family support available. For participant consent to the ESD program the team aimed for patient discharge from hospital to home within seven days after initial admission.

Interventions

Early supported discharge: Comprised up to a maximum of six weeks of home-based therapy. Patients were also provided a care package of three hours of assistance at home from the hospital which could be used for showering, groceries, cleaning or other duties the family felt was needed. Session content and frequency of therapy was based on participant’s individual needs.
scores ranging from 18 (lowest) to 126 (highest).

Five cognitive tasks. Tasks are rated on a seven point ordinal scale to assist patients with stroke. Referrals were made to other disciplines external to the ESD team as deemed appropriate. Physiotherapy focused on achieving individual patient goals and was individually tailored. This typically included gait retraining, balance, outdoor mobility and preparation for return to home ambulation. Speech therapy, occupational therapy and nursing care were provided as appropriate.

Outcome measures

All outcome measures were assessed by a physiotherapist blinded to allocation at the point of hospital admission and at six weeks post-acute stroke admission date for both intervention (ESD) and control group (IPR). The primary outcomes for the study were the Functional Independence Measure, EQ5D and length of stay. Secondary functional and quality of life measures were also included. Measures used are described below. No pre-existing medical co morbidities were recorded within the study. Existing medical co morbidities were recorded within the study. Differences between groups were assessed with independent t-tests for normally distributed data, Mann Whitney U tests for data that was not normally distributed, and Chi squared tests for categorical data. Changes in functional outcome measures were assessed using repeated measures ANOVA with time and group allocation as factors. All analysis was conducted using SPSS v22 (IBM, Chicago) and alpha was 0.05.

RESULTS

A total of 37 participants (23 male), mean age 70.9 years (SD14.8) participated in the study. Of the 37 participants, 19 were in the ESD group and 18 in the IPR group. There was no significant difference in age and gender between the groups (Table 1). The ESD group had a significantly shorter length of stay by a mean of 4.6 days (p<0.001) linked to elimination of wait for a rehabilitation bed. The ESD group had significantly higher quality of life (mean difference 89.9 to 69.5, p<0.001) than the IPR group. However, no significant impact on carer stress (p=0.31) was observed (Table 1).

The admission and discharge assessment results for the FIM, Berg Balance, mRS and NIHSS are presented in Table (2). There were no significant differences between groups in any of the scores at baseline. There was a significant effect of time for the FIM, Berg Balance, mRS and NIHSS (all p<0.001). Patients in the ESD group demonstrated end of study Berg Balance mean score of 53.7 (p=0.01) and mRS (p=0.01) relative to those receiving inpatient rehabilitation indicative of greater improvements in the ESD group. The interaction effect of group time was significant only for mRS (p<0.001), with the ESD group showing a larger
suggest that the benefits seen in clinical trials can be translated into our patient cohort. The comparable results of these two studies showed improvements in disability on the mRS is in agreement with a recent randomized controlled trial by Rasmussen et al, [16]. That investigated a similar effect in disability in the home based ESD program.

Baseline characteristics of gender, age and mRS were similar to cohort of participants in the mild to moderate stroke population. The improvement over time compared to the patients receiving inpatient rehabilitation.

DISCUSSION

Randomized controlled trials have demonstrated that an ESD program is a proven best practice model of care [8]. This is the first study to date within an Australian ‘real world’ health setting to compare outcomes between an ESD program and conventional inpatient rehabilitation for the acute mild-moderate severity stroke cohort. This study found that an ESD program has significant benefits for people who have suffered a mild-moderate stroke, and showed some benefits beyond standard inpatient rehabilitation. Significantly improved self-reported health related quality of life, reduced length of stay, and reduced disability levels were seen, which showed improved functional outcomes on our primary outcome, the FIM. Importantly, there was no significant increase in carer impact associated with the home-based ESD program.

The ESD program provided significant benefits in reduced levels of disability and trended towards significant improvements in FIM compared to the IPR group. The limitation of significance is thought to be due to the ceiling effect of the measure itself with patients included already scoring relatively high FIM scores in comparison to other stroke cohort populations. The improvement in disability on the mRS is in agreement with a recent randomized control trial by Rasmussen et al, [16]. That investigated a similar cohort of participants in the mild to moderate stroke population. Baseline characteristics of gender, age and mRS were similar to our patient cohort. The comparable results of these two studies suggest that the benefits seen in clinical trials can be translated into practice. In our study, although patients self-selected to the ESD or IPR group, we found no differences in baseline characteristics [17]. As patients were not randomized and allocation was based on preference, it is possible that the subset of participants that chose home based rehabilitation differed in terms of their self-efficacy, motivation and coping skills compared to those that chose the control. Factors which contribute to the success of the ESD participants need identification in future studies.

The home based form of rehabilitation utilized in the ESD program is perceived to be mostly positive by users of such services [18]. The home environment provides a contextually appropriate place for rehabilitation, enabling the patient to partake in therapy in familiar environment promoting confidence and independence. Being at home has previously been identified as a key component towards the perceived success of ESD programs [18]. These factors may have contributed to the improved quality of life EQoL seen in our ESD cohort compared to the IPR group.

Outcomes related to LOS show the significant cost-benefits to the health system with ESD participants having significantly reduced LOS. The RNSH ESD service saved a mean 4.6 bed days per patient to the hospital, which is less than the mean 7 days saving aggregated across clinical trials [19]. However this still equates to total cost savings of AUD$4048 (1 bed day = AUD$880) per patient, based on hospital data at RNSH, enabling the release of hospital beds for other acute admissions. These savings could potentially contribute to the sustainability of future ESD programs.

The main strength of this study is that it evaluated outcomes associated with the usual care ESD and IPR programs comparatively. Other strengths include the use of standardized assessment tools and the blinding of assessors to intervention group.

Limitations include non-randomization of subjects; the small sample size and short term follow-up, hence, long term maintenance of intervention effects are unknown. Despite the lack of power, we identified significant effects. Future studies should investigate the efficacy of ESD and IPR models with a larger sample size and a longer follow-up period beyond 6 and 12 months respectively. Characteristics of patients who choose ESD in comparison to those who choose IPR should be explored. The viability of ESD programs should also be explored for application in other contexts such as regional or remote communities, targeting mild to moderate stroke patients and

<table>
<thead>
<tr>
<th>TABLE 1: Demographic data.</th>
<th>ESD</th>
<th>IPR</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>67.7(13.7)</td>
<td>74.3(15.7)</td>
<td>0.177</td>
</tr>
<tr>
<td>Gender*</td>
<td>14 (73%)</td>
<td>9 (50%)</td>
<td>0.184</td>
</tr>
<tr>
<td>Length of Stay (days)</td>
<td>6.6 (3.8)</td>
<td>11.2 (2.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Carer Stress#</td>
<td>0 (0-1)</td>
<td>1 (0-2)</td>
<td>0.313</td>
</tr>
<tr>
<td>QoL(EQ5D) Therapy Time (min/day)</td>
<td>89.9 (8.7)</td>
<td>69.5 (8.6)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Abbreviations: ESD = Early Supported Discharge; IPR = Inpatient Rehabilitation; All data are mean (SD) except *Chi Squared, male: n (%) and #Mann Whitney: Median (IQR).

<table>
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<tr>
<th>TABLE 2: Outcome measures at admission and 6 week discharge.</th>
<th>ESD Mean (SD)</th>
<th>IPR Mean (SD)</th>
<th>P-value of between group difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIM</td>
<td>102.5 (11.9)</td>
<td>99.0 (15.8)</td>
<td>0.453</td>
</tr>
<tr>
<td>Berg</td>
<td>27.1 (14.2)</td>
<td>22.2 (15.1)</td>
<td>0.031</td>
</tr>
<tr>
<td>mRS</td>
<td>3.2 (0.9)</td>
<td>3.1 (0.8)</td>
<td>0.011</td>
</tr>
<tr>
<td>NIHSS</td>
<td>4.5 (4.8)</td>
<td>6.2 (5.3)</td>
<td>0.299</td>
</tr>
</tbody>
</table>

Abbreviations: ESD = Early Supported Discharge; IPR = Inpatient Rehabilitation; FIM = Functional Independence Measure; Berg = BergBalance; mRS = Modified Rankin Scale; NIHSS = National Institute Health Stroke Scale; SD= standard deviation.
incorporating use of tele-health technologies.

In summary, this study confirms and continues to provide evidence that ESD programs are a proven best model of care for patients following stroke. The efficacy of ESD programs in Australian clinical settings and reinforces the need to ensure such programs are widely available. It also supports previous research suggesting those with mild to moderate severity strokes are well suited to this approach. The application and implementation of an ESD program with a wider cohort of participants could strengthen the value of this type of post-stroke rehabilitation and its place within mainstream health services.

Clinical messages

1. Early Supported Discharge (ESD) programs are a proven best evidence model of care for patients following stroke.
2. An ESD program demonstrates significantly better functional improvements compared to an IPR program.
3. Application to a wider cohort of participants could strengthen the value of this type of post-stroke rehabilitation services.

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REFERENCES


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