Objective: To evaluate the effect on patient outcome of a teaching package for nurses designed to improve the positioning of stroke patients.

Design: Cluster randomized controlled trial with six-month follow-up.

Setting: Ten stroke rehabilitation hospital units located within one UK inner city region. These were randomized to control or intervention group.

Subjects: A sample of 120 patients admitted within four weeks of a first stroke and with a hemiplegia. No eligible patient refused to participate. Eighty-three (69%) completed the study.

Intervention: All nursing staff on the intervention units received a group teaching package to improve their clinical practice in patient positioning.

Main outcome measure: Rivermead Mobility Index (RMI) at six months post stroke. Patient’s position was recorded using an established observational tool.

Results: After the teaching there was some evidence of better positioning in the intervention than the control group (difference in percentage of correct positions per patient 4.9%, 95% confidence interval (CI −0.1% to 9.9%, \( p = 0.055 \)). There was no evidence of differences between the two groups in any of the outcome measures at six months although there was a trend towards increased elbow flexor tone in the control group.

Conclusions: A teaching intervention to improve patient positioning made no significant impact on outcome at six months post stroke. However, following the teaching there was only a slightly higher incidence of recommended patient positioning within the intervention group. Thus, a teaching package may not be powerful enough to enable any effect on patient outcome to be measured.
Introduction

Despite advances in the understanding of stroke and acute interventions to reduce further injury, co-ordinated multidisciplinary care is the only intervention consistently shown to reduce long-term mortality and disability in this patient group. However, little is known about the individual components of care that contribute to improved patient outcome.

It is generally thought that stroke morbidity is increased by inappropriate positioning during the early recovery phase. An intervention commonly advocated to minimize certain complications of hemiplegia and optimize functional outcome is to encourage the maintenance of ‘reflex-inhibiting’ patterns of posture such as those advocated by Bobath whose approach, although long standing, is still widely used in practice. In a recent survey of physiotherapists’ views the most frequently identified aim of positioning was to modulate muscle tone although there is currently no evidence to support the efficacy of such input.

It is thought that positioning strategies to modulate tone are only effective if patients are positioned consistently in recommended ways and that the presence of continued positive reinforcement may be important in enhancing desirable neuroplastic changes. Nurses are the only group of health professionals to be continuously present on the ward and thus are well placed to ensure that consistent, optimum positioning is achieved between the relatively short periods of specific therapy input.

However, there is evidence to suggest that the quality of positioning is variable on both general wards and specialist stroke units. Whilst it has been demonstrated previously that an educational intervention can bring about improved nurses’ knowledge and an increase in the incidence of ‘correct’ patient positioning it seems possible that the response to teaching input may vary between different clinical areas. No studies to date have evaluated the effect of recommended patient positioning on stroke outcome.

The aim of this research was to evaluate whether an educational programme for nurses increased the incidence of ‘correct’ patient positioning and affected the outcome of stroke patients six months later. We conducted a cluster randomized controlled trial to assess the outcome of first stroke patients who had received positioning care from specifically taught nursing staff. Since the effect of positioning on patients is not known, a range of measures were used to assess patient outcome at the level of impairment and disability. The Rivermead Mobility Index (RMI) was selected as the primary outcome in order to assess any effect of positioning on body mobility, whilst secondary outcomes assessed motor impairment, upper limb function and tone, walking speed and activities of daily living.

Subjects and methods

Data were collected from 10 stroke rehabilitation units within a UK city region. The units had between 12 and 24 beds available for stroke patients and at the outset were similar in the number of permanent nursing staff in post. Units were selected on the basis that patients were usually admitted at some point within four weeks following stroke and were likely to remain on the unit until discharged from hospital. All patients admitted to the units and meeting the following selection criteria were approached for their consent to participate in the trial.

1) Clinical diagnosis of first stroke.
2) Dependent on another person to position both the upper and lower limb.
3) Ability to walk independently prior to stroke but current inability to move from sitting to free standing without assistance.
4) No other confounding pathology causing gross limitation in joint movement.

The researcher liaised with members of the ward team to identify patients meeting the selection criteria. Patients were not approached if the staff deemed them too ill to be involved or had a very poor prognosis. Written informed consent was requested from all patients. Where this was not possible, for example, due to receptive dysphasia, assent was sought from close relatives on the understanding that patients would be approached for consent as their condition improved. The researcher was blind to the initial randomization
of units and therefore it was not possible to advise patients of the control or intervention status of their ward. The study had approval from multicentre and local research ethics committees.

All assessments were undertaken by a single researcher. Patients were assessed on entry to the study and at six months after stroke. For all but two patients, the six-month assessment was carried out in their place of residence. Measures consisted of the RMI, Motricity Index, Ashworth Scale for assessment of spasticity in shoulder abduction, elbow flexion and elbow extension, Frenchay Arm Test, timed 6-metre walk, sitting to standing and Barthel Index. The assessment carried out on entry to the study also included the following to establish group equivalence: Glasgow Coma Scale score on admission, premorbid Barthel Index score, presence of urinary incontinence at one week post stroke, the presence of visuospatial neglect, that were established from clinical records, and the ability to perform a shoulder shrug assessed by direct observation.

Data on patient positioning were collected using an existing observational tool. The tool consists of a schedule that directs the observation of 21 aspects of posture that have been identified as potentially important in the return of normal function following stroke. The 21 aspects of posture make up one set of observations. Each unit was visited by the researcher a minimum of once every two weeks. Visits alternated between morning and afternoon to reflect nurses’ shift patterns. Patients were observed throughout their admission according to their availability and observations were made on weekdays between 09:00 and 20:00. Where multiple observations were made of individual patients in one day, these were at intervals of at least 30 min with no more than four consecutive observations made on each patient.

The observations were marked as either correct or incorrect by comparing them directly to sets of recommended positions made, through consensus, by a group of clinical neurophysiotherapists from two London hospitals. A linear regression model was used to relate the proportion of criteria satisfied by the positioning of each patient to the arm of the trial and the position the patient was in (supine, lying on affected or unaffected side, sitting in chair or wheelchair). Multilevel models were used to allow for the fact that the same patients were often observed more than once, and for clustering within site.

All nursing staff members (trained nurses and health care assistants) on each of the intervention wards received the teaching package consisting of one full study day. The first half of the day focused broadly on the definition and aetiology of stroke, factors influencing recovery, the multidisciplinary team’s role in rehabilitation, the influence of ergonomics on movement and positioning and issues relating to moving and handling. The second half was dedicated to practical work on the ward with nurses being taught and helped to develop skills in the appropriate positioning of the patients they were caring for.

The day was repeated on each unit to enable all nursing staff to attend. Each nurse received a workbook that contained materials to support the content of lectures and required completion both during the lectures and afterwards in the nurses’ own time. Once completed, it provided an aid to revision and a resource tool. Two half-day workshops were then given at approximately five-monthly intervals during the study to reinforce the messages previously taught and to allow group reflection and discussion of the implementation of the teaching into practice. These follow-up workshops ensured that any nursing staff appointed to the unit during this time also received the teaching input. Two lecturers in nursing who had specialist experience in neuroscience and rehabilitation carried out the teaching package, which had been developed, tested and refined during earlier work.

Random numbers were used to allocate the 10 stroke units. Block randomization was not used due to the small number of units involved and their similarity in terms of staffing levels and service configuration. Five units were in the control and five in the intervention group. All nursing staff from within the intervention group received a programme of teaching. One hundred and twenty patients meeting the inclusion criteria were identified to the researcher and recruited from across the units. Data were collected over a period of 21 months. Patients were assessed on entry to the study and at six months post stroke. Their positioning was observed and recorded throughout their stay in order to establish efficacy of the teaching intervention.
Data collected in previous work \cite{12} had produced a standard deviation of 3 for the RMI. To have 80% power to detect an expected effect size of 2.5 points on the RMI at the 5% significance level it was calculated that 10 clusters would be needed, with an average of eight patients per cluster (conservatively assuming an intraclass correlation coefficient of 0.1). This equates to a total of 120 patients recruited from 10 clusters allowing for an attrition rate of approximately 30%.

Differences in baseline characteristics, stroke severity and outcome between the two arms of the trial were analysed using linear (continuous outcomes) and logistic (binary outcomes) regression. In both cases random effects regression was used to account for the clustering of individuals within units. Analysis of variance was used to calculate the intraclass correlation coefficients that quantify the degree to which individuals within the same unit are similar. \cite{24}

**Results**

One hundred and twenty patients agreed to participate in the study over a period of 15 months. No eligible patient refused to take part. Sixty-eight (57%) were admitted to the control arm and 52 (43%) to the intervention arm. There was no statistical evidence of a difference in the proportion of patients followed up at six months, with 49 (72%) completing the trial in the control group and 34 (65%) in the intervention group. The flow of patients through the trial is shown in Figure 1. Although this was a cluster randomized trial, there was no evidence of a clustering effect on outcome (e.g., the intraclass correlation coefficient for the RMI was 0). Therefore, although we have adjusted for clustering in the analysis, we have for ease of interpretation presented the data on an individual level.

The demographic characteristics of the patients are shown in Table 1, and stroke severity indicators in Table 2. There was no strong evidence of differences in any of the variables between the two groups at baseline, except that those in the control group were younger. There was no evidence of a difference in follow-up rate between the two arms of the trial (odds ratio for follow-up in intervention compared to control arm 0.82, 95% confidence interval (CI) 0.25 to 2.65, \( p = 0.7 \)). When comparing followed up to missing patients (survivors at six months only), the only difference between the two groups was that those followed up tended to be younger (odds ratio for follow-up 0.9 per 1 year increase in age, 95% CI 0.8 to 0.98, \( p = 0.01 \)).

Five hundred and forty-two sets of observations of patients’ position were obtained. Two hundred and thirty-five were collected before the teaching and 307 afterwards. Of these sets, 117 (21.6%) were of patients lying supine or laterally and 424 (78.2%) were of patients sitting either in a chair or wheelchair. One set (0.2%) was made of a patient sitting in bed. It was not possible to collect data on all 21 aspects of posture for every set of observations made. This was due to patients being partly obscured by clothing or bedding, or moving their head, arm or leg independently. In total, 8502 individual aspects of posture were observed.

Prior to the intervention there was no difference between the two arms of the trial in the percentage of the 21 aspects of posture positioned correctly per patient (difference 1.8%, 95% CI −3% to 7%, \( p = 0.45 \)). At baseline, patients in the intervention group were positioned correctly for a median of 50% (range 18.8–87.5%) of the aspects of posture within each set of observations (\( n = 145 \)) and those in the control group for a median of 48.1% (range 12.5–81.3%; \( n = 90 \)). Following the teaching there was some evidence of better positioning in the intervention compared to the control group (difference 4.9%, 95% CI −1% to 9.9%, \( p = 0.055 \)). Patients in the intervention group were positioned correctly for a median of 62.5% (range 25–100%; \( n = 133 \)) and those in the control group for a median of 54.4% (range 0–100%; \( n = 174 \)). Overall, there was evidence of an improvement in positioning within the intervention group of 6% (95% CI 2% to 10%, \( p = 0.004 \)) following the teaching.

The outcomes at six months in both intervention and control arms are shown in Table 3. The 95% confidence intervals shown are for the excess of outcome in the intervention group compared to the control group and have been adjusted for the cluster randomized design. The primary outcome for this trial was the RMI at six months. The mean RMI in the intervention and control groups was
4.7 (SD = 3.39) and 4.8 (SD = 3.92) respectively (95% CI –1.7 to 1.6, p = 0.92). In calculating the sample size, a difference in the RMI of 2.5 points was deemed to be clinically significant. There was therefore no evidence here of a clinically relevant difference in the RMI between the intervention and control arms.

Similarly there was no evidence of a statistically significant difference between control and intervention arms of the trial in any of the other outcomes assessed (Table 3). For the Motricity Index (arm, leg and total) all 95% confidence intervals included differences between the two arms of less than 15. A difference in the Motricity Index of 20 points was deemed to be clinically significant, so again there was no evidence of clinically relevant differences between the two groups as all the confidence intervals indicated likely differences between the two groups of less than this. Adjusting for age and other baseline variables did not change these conclusions.

However, there was evidence (although not statistically significant) of a difference between the two groups for the Ashworth Scale, with a
higher number of patients in the control group scoring three or above for shoulder abduction, elbow flexion and elbow extension (where the difference was particularly pronounced).

### Discussion

This study sought to investigate the effect of recommended positioning on patient outcome following stroke. The cluster randomized controlled trial recruited patients from 10 stroke rehabilitation units. The two groups were well matched in all demographic characteristics and stroke severity indicators, with the exception of mean age, which was lower in the control group.

Overall, this study has not demonstrated any clinically significant differences in the outcome of patients cared for by nursing staff on stroke units who have received a formal programme of teaching to improve their clinical practice of patient positioning. However there was some indication of increased elbow flexor tone in the control compared to the intervention group. This may be relevant, as studies evaluating treatments to reduce spasticity in the upper limb have demonstrated that a reduction in spasticity leads to a decrease in disability and carer burden and improves voluntary motion and functional capability.

Overall, some improvement in patient positioning following the teaching intervention was demonstrated. However the large range in median percentages of correct positioning indicated that within both groups aspects of positioning was very poor for some patients. In addition it is likely that the impact of the teaching was variable and improvements in positioning practice may not have occurred on all intervention units. A variable response to teaching input has been noted in previous work where nurses’ theoretical knowledge increased in both intervention and control groups. This was thought likely to be due to the nurses’ recruitment to the study and their subsequent raised awareness and interest in stroke care, particularly as data collection involved the researcher carrying out direct observations of their patients’ posture.

Changes in quality of patient positioning may also have been affected on all units by other factors.

### Clinical messages

- It is possible to initiate improvements in the quality of patient positioning through nurse education.
- It may not be possible to increase the incidence of recommended positioning sufficiently to enable an effect on patient outcome to be measured.
- Poorer positioning may be associated with increased elbow flexor tone.
beyond the control of the research team. These included inevitable staff changes during the course of the study; two units experienced a change in ward manager, and periods of low staff numbers. Other organizational elements may have had a positive effect. For example, where the physiotherapy gym was located on the ward itself the physiotherapists appeared to be particularly prominent and involved in patient care. It is possible therefore that not enough of a difference was established between control and intervention groups following the teaching to allow any detectable difference in patient outcome to be measured.

Inevitably there were some limitations to the study. Patient attrition was slightly higher than expected although the power of the study was not compromised. In addition, patient recruitment had to be discontinued from two units when they no longer met the selection criteria. This arose when their status changed to that of an acute stroke unit with patients being transferred to other settings within two or three weeks of admission. Although initially blind to randomization, the researcher became unblinded to the randomization of three intervention units in the latter part of the study when nursing staff talked about the teaching they had received. Although this was unavoidable, the use of a second researcher to carry out data collection from these units would have helped to eliminate possible bias. Lastly, it was not within the scope of the study to assess the quality of moving and handling by nurses and other professional groups during patient transfers, repositioning or clinical examination. Although the teaching intervention included instruction in this area, the observational tool used to collect data on patient positioning allowed only for the recording of static posture. It is possible that patient outcome may also be influenced by these other factors.

This study indicates that nursing practice can be positively influenced through teaching in some clinical areas. Although the overall incidence of recommended patient positioning was increased, a significant improvement in patient outcome was not seen. It seems unlikely that positioning practice can be influenced sufficiently through nurse education to enable any effect on patient outcome to be measured.

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References


